VALUE ENGINEERING STUDY

US Army Corps
of Engineers

NEW ORLEANS DISTRICT
USACE

SELA Flood Control, Orleans Outfalls East Bank of Orleans Parrish, Louisiana

Final Report

April 2001

rsr "the value solutions team"
Robinson, Stafford, & Rude, Inc.

BLACK & VEATCH

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VALUE ENGINEERING STUDY

DOD SERVICE:	Army
VALUE ENGINEERING OFFICER:	Frank Vicidomina
VE CONTROL NO.:	CEMVN-VE-01-06

New Orleans District

SELA Flood Control, Orleans Outfalls
East Bank of Orleans Parrish, Louisiana

February 12-16, 2001

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VALUE ENGINEERING STUDY

PROJECT TITLE: ***SELA Flood Control, Orleans Outfalls***

PROJECT LOCATION: ***East Bank of Orleans Parrish, Louisiana***

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EXECUTIVE SUMMARY

VALUE ENGINEERING STUDY

PROJECT TITLE: ***SELA Flood Control, Orleans Outfalls***

PROJECT LOCATION: ***East Bank of Orleans Parrish, Louisiana***

EXECUTIVE SUMMARY

This report presents the results of a VE study conducted to review the concept design of the SELA Flood Control, Orleans Outfalls for the U.S. Army Corps of Engineers, New Orleans District.

Black & Veatch Special Projects Corporation in association with Robinson, Stafford, & Rude, Inc. (RSR) conducted the VE workshop at the New Orleans District Office. Excellent cooperation was provided by the New Orleans District Project Team and the A/E Design Team.

The VE process used to review this project is an organized, multidisciplinary process designed to find alternative ways to achieve the project's necessary and desired functions at the lowest life cycle cost. The VE Team identified the important project functions and possible alternative ways to achieve them. The team then selected the best alternatives and developed them into workable recommendations for project improvement and cost savings.

PROJECT DESCRIPTION

The SELA Flood Control, Orleans Outfalls project is designed to reduce localized flooding in specific areas within Orleans Parrish. The project consists of:

- Improvements to Drainage Pump Station (DPS) #7
- Construction of a new concrete box culvert (CBC) connecting an existing CBC to DPS #7
- Construction of the Harrison Pump Station (HPS) and an associated CBC
- Construction of the Robert E. Lee Pump Station (RPS) and an associated 72-inch diameter drain pipe

VALUE ENGINEERING PROCEDURE

The 40-hour workshop took place from February 12-16, 2001. This study followed the format of the six-step Value Engineering Job Plan. The process is consistent with the SAVE International and U.S. Army Corps of Engineers standard value methodology. Each step is designed to achieve results and assure savings to the Corps of Engineers.

PROJECT COST ANALYSIS

As a part of this workshop, the team reviewed the project cost estimate. This review validated costs ensuring that the team members had reliable data to use as the basis for estimating the cost of the Original Concept and the Proposed Concept. The cost estimate presented to the VE Team was only a preliminary estimate based on a 10 percent concept design. A corresponding level of accuracy was used to determine the savings from the recommended proposals. The review also served as a check on the accuracy of the design estimate in terms of the costs for the principal project components and the major unit cost items. Several cost models were developed to identify the high cost areas and the cost drivers within those areas. This review concluded that:

- The Orleans Ave. CBC was the major cost driver (75.4% of the total project cost)
- Cost drivers for the Orleans Ave. CBC were identified as
  - Cast-In-Place (CIP) concrete at 42.4%
  - Sheet pile/bracing at 24.1%

VE RECOMMENDATIONS

Section 3 – Summary of Recommendations, includes a complete list of all the recommendations developed during the workshop. This table shows the number and title of the idea as well as a summary of the cost savings associated with each recommendation. The cost savings shown are based on capital, or first costs, and the life cycle costs. Life cycle costs include the capital cost, plus operations, maintenance, energy, replacement and salvage value costs over the economic life of the project. When a recommendation resulted in a significantly shorter construction schedule, savings were estimated by computing the interest cost of the Original Concept for the length of time after the Proposed Concept would have been completed.

Many of the recommendations for the Robert E. Lee and Harrison Avenue Pumping Stations were based on similar concepts and for that reason several of the ideas were combined and all the pumping station recommendations are located in one section of the recommendations. The identification for recommendations that relate to both pumping stations are identified with the creative idea number from which each idea originated; e.g., RPS-41 & HPS-10.

Some recommendations presented in this report are variations of a common concept and others are alternatives to a specific aspect of the design. Thus, not necessarily all recommendations in this report can be implemented, because, selection of some will preclude or limit the use of others.

These potential savings do not reflect any costs for redesign, which must be considered. Moreover, the full benefit and impact of many of the recommendations goes beyond the cost savings to include improved project performance of required functions.

It should also be noted that these are recommendations only. Final responsibility for acceptance and design rests with the District and the Design Team.

PROJECT DESCRIPTION

PROJECT DESCRIPTION

The proposed plan for the Orleans Ave./London Ave. Basins (Subbasin D/E) consists of the following: Construction of a new concrete box culvert (CBC) (22'W x 11'H) along Orleans Avenue from Scott Street to Drainage Pump Station (DPS) #7. In addition to this improvement, the pumping capacity of DPS #7 will be increased by 900 cfs (750 cfs as a result of the Hurricane Protection Project). The new pump will be housed in the facility being constructed for new pumps required for the Lake Pontchartrain Hurricane protection project.

Two new pump stations (PS) with intakes will be constructed. One PS will be located along Harrison Avenue at the 17th Street Canal, with a covered box culvert (BC) (12'W x 10'H) extending from the PS along Harrison Ave. to Fleur des Lis Drive. Another PS will be located at Robert E. Lee and the Orleans Avenue Canal (250 cfs). A 72-inch diameter drain pipe will extend from the PS along Robert E. Lee Blvd. to Petrony Alley, then proceed south on Petrony to Mouton St., then turning west on Mouton St. heading one block to Argonne Blvd. The two new pump stations will be housed in new facilities.

Access to the work areas would be attained from major highways and city streets. The covered canals under the Neutral Ground of Orleans Ave., as well as the DPS inlet canal under Harrison Ave. and the inlet pipe under Petrony Alley (Robert E. Lee DPS) will be new canals/pipe. The DPS will be new facilities.

Construction of canals/pipes will occur in two or three block increments. Traffic along the "avenue" blocks affected by construction would be reduced to two lanes. The affected "streets" would be reduced to one lane private home access or completely closed to traffic. Traffic in the affected blocks of the streets will be rerouted to adjacent streets during the construction period. All street closures will be coordinated with the City of New Orleans Dept. of Public Works to ensure City services and safety operations can be maintained at all times.

The project is estimated to take four years to complete. For construction of all components, a steel sheet pile internally braced cofferdam will be constructed to excavate, dewater, and construct the new canals and DPS. Site work would require excavation and hauling of approximately 72,983 CY of sediment and reuse of 62,816 CY of material as backfill. Sheet piling will be driven with a standard crane equipped with a vibratory hammer to reduce noise and vibrations to surrounding buildings.

Approximately 35,000 CY of concrete will be placed during construction of the canals and DPS and their inlets. It is anticipated that concrete will be transported in transit mixers to the site and will be placed by either concrete bucket or pumping operations.

Construction would occur in existing New Orleans Sewerage Water Board rights-of-way, or within the City of New Orleans Street (Orleans Ave.) or property (Harrison Ave. DPS and Robert E. Lee DPS) ROW, for which the S&WB can obtain a construction permit.

SUMMARY OF RECOMMENDATIONS

Table 3-1

SUMMARY OF RECOMMENDATIONS

Idea No.	Idea Description	First Cost Savings	*Interest and O&M Cost Savings	Life Cycle Cost Savings
GS-1 & GS-2	Perform incremental analysis to optimize plan.	9,000,000	2,986,000	11,986,000
C-2B	Replace CIP box culvert with arch pipe.	600,000	400,000	1,000,000
C-64	Eliminate wooden piles under box culvert.	1,778,000	0	1,778,000
C-67	Alternative splash protection.	760,000	0	760,000
RPS-1	Replace vertical pumps with submersible pumps.	47,000	0	47,000
RPS-5A	Locate submersible pump station near intersection of Argonne and Mouton St. and force main to Orleans canal.	2,177,000	0	2,177,000
RPS-5B	Same as above, but different flow rate.	1,970,000	0	1,970,000
RPS-8 & HPS-1	Reduce Pump Station sizes to 100 CFS and 200 CFS respectively.	917,000	376,000	1,293,000
RPS-19	Use single pump.	361,000	97,000	458,000
RPS-39	Replace concrete pipe with HDPE.	30,000	0	30,000
RPS-41	Lower RPS and HPS to ground level.	23,000	0	23,000
HPS-2A	Locate submersible, or vertical, pump station near Fleur de Lis and Harrison St. and force main to 17th canal.	758,000	0	758,000
HPS-2B	Similar to HPS-2A, but at different flows.	242,000	0	242,000
HPS-3	Replace box culvert with pipe.	85,000	70,000	155,000
HPS-9	Use single pump.	588,000	111,000	699,000

* Present Worth

VE Recommendations

GENERAL RECOMMENDATIONS

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO.: GS-1 & GS-2

PROPOSAL PAGE NO.: 1

DESCRIPTION: Perform Incremental Analysis to Optimize Plan

CRITERIA CHALLENGE: No **CRITERIA NO.:**

ORIGINAL CONCEPT: Current plan identifies construction of Orleans Ave. Canal Culvert and Gate, upgrade of P.S. #7, new Robert E. Lee and Harrison Ave.'s P.S.'s and Culverts as National Economic Development (NED) Plan (Estimated total cost @$40 million).

PROPOSED CONCEPT: Perform incremental analysis on major project features as well as reconsider Pump to River (Alt.#5) as a separate or combined feature. Specifically, propose analysis of the following comprehensive alternatives:

(1) Current project without Robert E. Lee and Harrison Ave.'s P.S.'s and Culverts (RPS & HPS)

(2) Current project without RPS & HPS, plus, River Pump Station (Alt.#5)

(3) Upgrade of P.S.#7 only, with or without RPS & HPS

(4) Upgrade of P.S.#7 only, plus, Alt#5 with or without RPS & HPS.

(*) The 750 CFS upgrade of P.S. # 7 accomplished by another federal project may (should) be considered as "existing conditions" with benefits <u>not</u> appropriately attributed to this project.

SUMMARY OF COST SAVINGS (based on option (1) above)

	FIRST COST	PRESENT WORTH OF O&M COSTS	INTEREST COST DURING CONSTRUCTION*	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$40,000,000	$2,519,000	$2,600,000	$45,119,000
PROPOSED CONCEPT	$31,000,000	$118,000	$2,015,000	$33,133,000
SAVINGS	$9,000,000	$2,401,000	$585,000	$11,986,000

* See pages 4-7 and 4-15.

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Optimizes plan selection by:
  - Lowering overall project cost
  - Increasing annual benefits

DISADVANTAGES:

- Would require some additional, but relatively minor, analysis time and cost

JUSTIFICATION:

Current data on project benefits suggest that some form of incremental analysis is warranted. The question as to whether or not the incidental upgrading of P.S. #7 should be considered as "existing conditions" is significant. The pump to river option (Alternative #5) still appears viable particularly if recommended reconfiguration is applied that would lower cost. The alternatives proposed for re-analysis already have individual components included in the hydraulic model. Evaluation of these plans should not, therefore, require significant study time or cost.

DISCUSSION

In evaluating the total project benefits and sub-basin breakdown, in conjunction with the proposed project construction features, several significant items of information became apparent to the VE Team and are summarized in the list below. An in-depth discussion of each of the issues listed below follows.

- The substantial upgrading of P.S. #7 (750 CFS) appears both incidental to this project and to independently produce significant benefits that accrue to the remaining project elements.
- The current plan single value B/C ratio appears marginal.
- The RPS & HPS features do not appear to be incrementally justified.
- There appears to be some overlapping (interdependence) of benefits that result from each major feature.
- The "Pump to the River" option (Alt.#5) has a favorable B/C ratio and could be enhanced further with some cost saving modifications recommended in this report.
- A revised combination of major features may likely produce a different NED Plan with an improved B/C ratio.

In addition to the preceding information, the VE Team factored in new information that was developed during the VE workshop to re-analyze the project. This information further supports the recommendation to re-evaluate the numerous project options to determine the best combination. There was not sufficient information available to the VE Team to make a final determination; however, the information developed in this alternative is sufficient to recommend additional review.

<u>The substantial upgrading of P.S. #7 (750 CFS) appears incidental to this project</u> - A substantial portion (750 CFS or ~80%) of the 950 CFS upgrade to P.S. #7 will be completed as part of a separate federal project (Fronting Protection). A minor cost to this project of about $700,000 would still be needed for suction basin expansion to make the 750 CFS upgrade effective. It may not be proper to count the significant benefits derived from the 750 CFS upgrade in the B/C ratio of the SELA Flood Control project. The upgrade to P.S. #7 may be more appropriately included as "existing conditions."

<u>The current plan B/C ratio appears marginal</u> - Refer to the attached tables illustrating the current project benefits and costs with breakdown and adjustments. The apparent "single

value" B/C ratio, calculated at 0.98, is not favorable. Applying Risk and Uncertainty Analysis (R/U) may indicate more favorable results. A comprehensive R/U analysis should, however, indicate significant probability items that would negatively impact project benefits. Such notable risk items include:

- Pump station reduction of capacity in coincidence with tropical storm activity (high tide)
- Pump station capacity reduction due to mechanical unit failure
- Pump station failure due to coincidental power supply interruption (very significant given current design of proposed RPS & HPS stations).

<u>The RPS & HPS features do not appear to be incrementally justified</u> - Reference the attached tables illustrating the benefit distribution and B/C calculation for incremental parts of the current proposed plan. A cursory analysis of the benefits distribution indicates that both the RPS and HPS features, when considered individually, are not in the national interest to construct (Incremental B/C's of 0.36 and 0.47, respectively). *This analysis relied on best distribution assumptions primarily for Sub-basin EJ where benefits are generated from both RPS and P.S.#7. It is recommended that a model verification be performed.* Significant cost reduction measures recommended in other proposals in this report could be implemented to more favorably enhance these features.

<u>There appears to be some overlapping (interdependence) of benefits that result from each major feature</u> - The benefits distribution clearly indicates that there is some interdependence between, and among, the performance of P.S.#7, P.S.#12, the proposed RPS and HPS. This implies that all benefits attributed to each major project feature would not be lost given its independent removal from the overall project.

<u>The proposed upgrade of P.S.#7 alone appears to independently produce significant benefits</u> – Refer to the benefits distribution tables and map. There are significant project benefits in Sub-basins EJ and EN that are apparently attributable strictly to the 900cfs capacity increase at P.S. #7. These benefits result more from the credit obtained through the Fronting Protection Project, and represent a very small cost to this project. This would imply that other features may have limited 'bang for the buck'.

<u>The "Pump to the River" option (Alt.#5) has a favorable B/C ratio and could be enhanced further with some cost saving modifications</u> – As referenced in the attached presentation materials, the "Pump to the River" options were eliminated because of the "10-to-1" (annual benefits-to-first cost) criterion. If this criterion were applied to the current plan, it would also be eliminated. A more precise calculation of B/C ratio is presented in the attached table for Alternative #5, which was the more favorable pump to the river option. The apparent B/C for Alt.#5 is a favorable 1.19. Further refinement of this option that improve the B/C ratio to 1.43 include: (1) the use of submersible pumps, (2) relocation of the proposed station, and (3)

utilization of a pressure conveyance system (see cost change table). Elimination of Alt. #5 appears to have been premature.

A revised combination of major features may likely produce the NED Plan – Given the information provided above, particularly the apparent independent non-viability of the proposed RPS and HPS features along with the significant independent viability of P.S.#7 improvements and Alt.#5, it is very likely that one of the four plans recommended in this proposal for further analysis would be the NED plan.

The table on the following page was excerpted from material provided by the Design Team and was revised to include the Sump Expansion of P.S. #7 and the Cover for P.S. #2 Outfall Canal.

PROPOSAL NO.: GS-1 & GS-2

PROPOSAL PAGE NO.: 6

ORIGINAL CONCEPT – CALCULATIONS (Revised)

Area E - Orleans Avenue For Optimum Plan				
Item	**Quantity**	**Unit**	**Unit Price**	**Cost**
Note: Optimum Plan				
1. Orleans Avenue, Scott - DPS #7	1	LS	$24,163,000.00	
22' W x 12' D Box				
with Gate at Jeff Davis				
1A. Sump Expansion of P.S. #7	1	LS	$629,000.00	
1B. Cover of P.S. #2 Outfall Canal	1	LS	$831,000.00	
				$25,623,000.00
2. 1050 CFS at DPS #7	1	LS	$180,000.00	$180,000.00
cost equals net difference between				
3-350 CFS Pumps and 3-250 CFS Pumps				
3. New 12' W x 10' D Box	1	LS	$1,600,000.00	$1,600,000.00
Under Harrison, Fleur De Lis Avenue				
to 17th street Canal				
4. New 400 CFS Pump Station	1	LS	$2,300,000.00	$2,300,000.00
Harrison Avenue at 17th street Canal				
5. 6' Diameter Pipe - Argonne to	1	LS	$1,900,000.00	$1,900,000.00
Robert E. Lee via Mouton and				
Petroney Alley				
6. New 250 CFS Pump Station	1	LS	$1,700,000.00	$1,700,000.00
Robert E. Lee at Orleans Canal				
Sub-Total				$33,303,000.00
E&D 10% +/-				$3,330,300.00
S&A 10% +/-				$3,330,300.00
TOTAL	(ROUNDED)			$40,000,000.00

ORIGINAL CONCEPT - CALCULATIONS

Using the revised information in the preceding table the following determination was made.

CURRENT PLAN
Estimated B/C Ratio for Total Project:
(single value calculation)

						TOTALS
First Cost (See attached revision)						$40,000,000
Interest lost during 3-yr construction	Spent	Total	Remaining	Interest		
End of Year 1	-$13,333,333	$40,000,000	$26,666,667		$1,733,333	
End of Year 2	-$13,333,333	$26,666,667	$13,333,333		$866,667	
					$2,600,000	$2,600,000
Subtotal						$42,600,000
	Total Cost		CRF		EAC	
Equiv. Annual Cost (EAC)	$42,600,000	Times	0.0679139		$2,893,133	$2,893,133
O&M Costs (Supporting information follows)						$171,000
Total Annual Costs						$3,064,133
Total Annual Benefits (Supporting information follows)						$2,992,000
Net Benefits						-$72,133
B/C						0.98

ORIGINAL CONCEPT - CALCULATIONS

A determination of the annual cost for the Original Concept follows:

YEARLY O&M AND REPLACEMENT COSTS

Orleans Ave. Box O&M (Cleanout)		$7,600
Harrison Ave. Box O&M (Cleanout)		$600
Harrison Ave. Pumping Station		$70,000
Robert E. Lee Pumping Station		$70,000
	Subtotal	$148,200
	Total Annula O&M (Rounded)	$150,000

25-YEAR REPLACEMENT/REHAB OF PUMPS AND MOTORS

Harrison Ave. Pumping Station		$800,000
Robert E. Lee Pumping Station		$750,000
	Subtotal	$1,550,000
Total 25-year Replacement/Rehab Pumps and Motors (Rounded)		$1,500,000

DETERMINE EQUIVALENT ANNUAL COST OF PUMP REPLACEMENT/REHAB

Replacement Cost at Year 25 = $1,500,000 x SPPWF
= $1,500,000 x 0.20714 = $310,710

Equivalent Annual Cost of the
Replacement Cost (over 50 years) = $310,710 x CRF
= $310,710 x 0.06791 = $21,000 (Rounded)

Total Annual Cost of O&M and Repl. = $150,000 + $21,000 = $171,000

PROPOSAL NO.: GS-1 & GS-2

PROPOSAL PAGE NO.: 9

ORIGINAL CONCEPT - CALCULATIONS

The Average Annual Benefits have been revised in the table that follows to include an additional 20 percent for Indirects and to include Alternative #5.

ORLEANS FEASIBILITY STUDY **22-Jan-99**

ORLEANS AVENUE CANAL

ALTERNTIVE 3

revision 20 USING LOWEST STRUCTURE ELEVATION

		AVERAGE ANNUAL BENEFITS				
SUB-AREA (Ref. Attached maps)	**AV ANNUAL DAMAGE**	**OPTIMUM**	**SIZE UP**	**SIZE DOWN**	**COMBO OAC+**	**INDIRECTS +20% [1]**
EA	$588,849	$0	$0	$0	$0	$0
EB	$527,203	$503,650	$504,306	$504,306	$501,665	$602,000.00
EC	$381,714	$0	$0	$0	$0	$0.00
ED	$190,561	$170,663	$171,524	$170,663	$162,601	$195,000.00
EE	$33,005	$17,737	$17,737	$17,737	$17,708	$21,000.00
EG	$255,842	$12,880	$12,880	$12,880	$12,880	$15,000.00
EH	$106,841	$106,100	$106,462	$103,559	$106,112	$127,000.00
EI	$80,110	$70,744	$70,211	$70,211	$66,954	$80,000.00
EJ	$889,574	$778,477	$776,736	$673,121	$761,097	$913,000.00
EN	$329,101	$206,337	$206,337	$206,337	$199,362	$239,000.00
TOTAL	**$3,382,800**	**$1,866,588**	**$1,866,193**	**$1,758,814**	**$1,828,379**	**$2,192,000**
LONDON AVENUE CANAL						
3	**$393,805**				**$378,504**	**$454,000**
4A	**$336,748**				**$288,450**	**$346,000**
LAC TOTAL	**$730,553**				**$666,954**	
LAC+OAC	**$4,113,353**				**$2,495,333**	**$2,992,000**
ALT. #5					**$995,000**	**$1,194,000**

[1] INDIRECTS = AUTOS, EMERGENCY, INSURANCE COSTS, ETC.

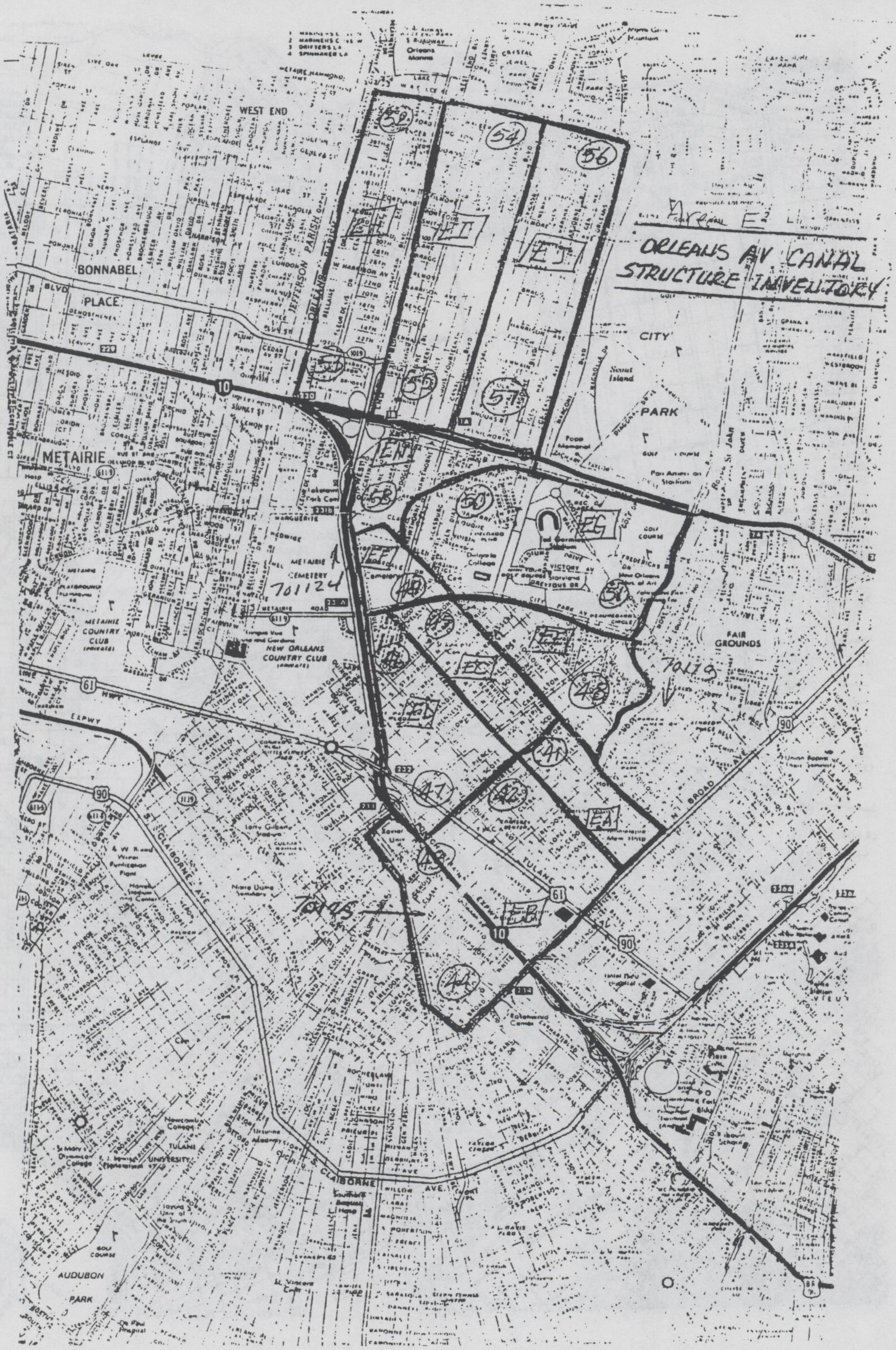
ORIGINAL CONCEPT - CALCULATIONS

The following table indicates the incremental benefits of the three principal project components and the total benefits.

ESTIMATED INCREMENTAL BREAKDOWN OF BENEFITS (CURRENT PLAN)

	ALLOCATED TO PROJECT COMPONENT:			
SUB-AREA (see attached)	**Pump Station #7 & Orleans Ave. Culvert**	**Robert E. Lee PS**	**Harrison PS**	**BENEFITS + 20%**
EA	$0	$0	$0	$0
EB	$602,000			$602,000
EC	$0	$0	$0	$0
ED	$195,000			$195,000
EE	$21,000			$21,000
EG	$15,000			$15,000
EH			$127,000	$127,000
EI		$20,000	$60,000	$80,000
EJ	$800,000	$113,000		$913,000
EN	$239,000			$239,000
3	$454,000			$454,000
4A	$346,000			$346,000
TOTAL:	**$2,672,000**	**$133,000**	**$187,000**	**$2,992,000**

REFERENCE INFORMATION – SUB-AREAS

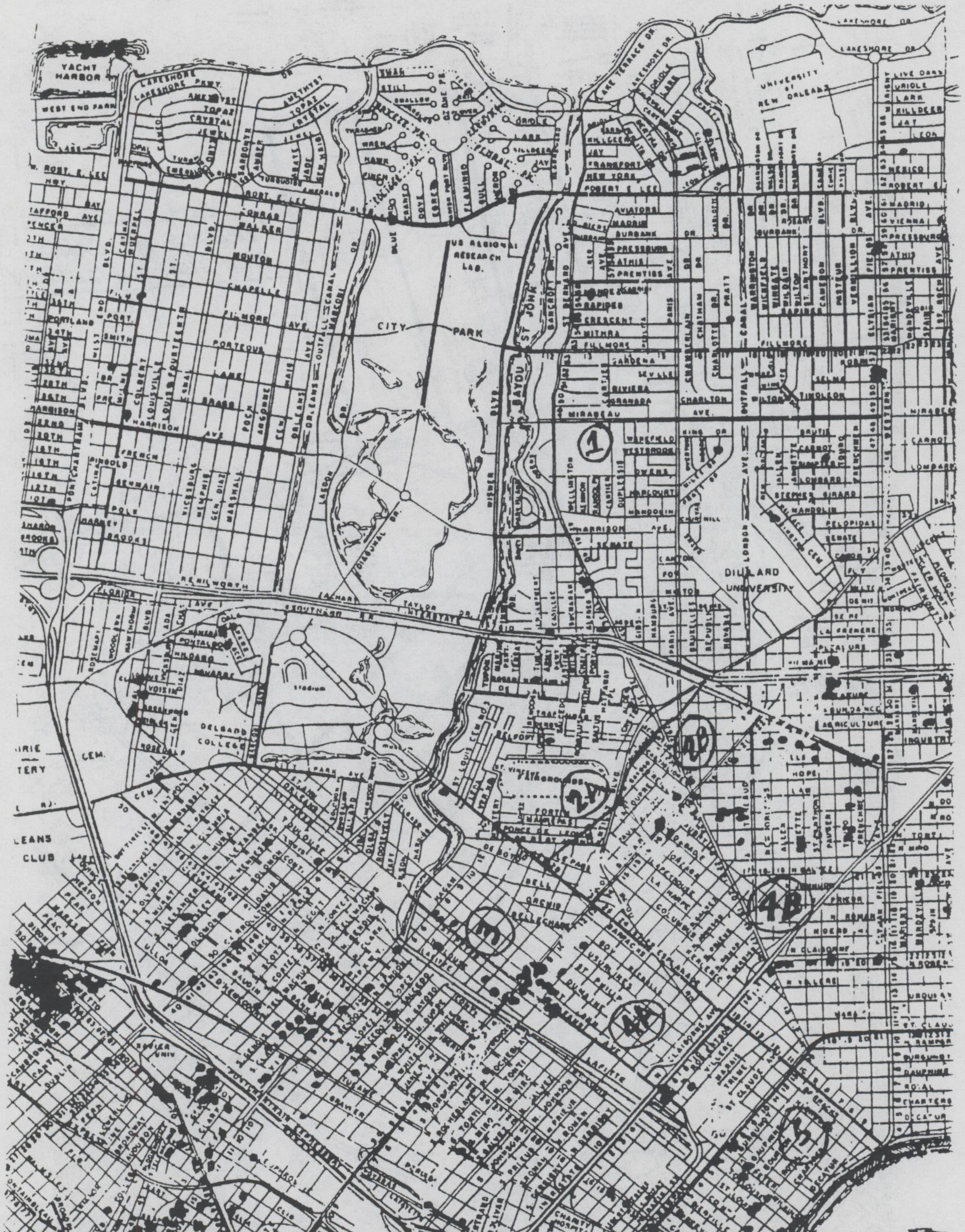


VALUE ENGINEERING STUDY

PROPOSAL NO.: GS-1 & GS-2

PROPOSAL PAGE NO.: 12

REFERENCE INFORMATION – SUB-BASIN D



ORIGINAL CONCEPT - CALCULATIONS

(incremental analysis)
Estimated B/C Ratio for Robert E. Lee P.S.
(single value calculation)

					TOTALS
First Cost					$4,320,000
Interest lost during construction					
					$0
					$0
Subtotal					$4,320,000
	Total Cost		CRF	EAC	
Equiv. Annual Cost (EAC)	$4,320,000	Times	0.0679139	$293,388	$293,388
O&M Costs					$80,000
Total Annual Costs					$373,388
Total Annual Benefits (See attached)					$133,000
Net Benefits					-$240,388
B/C					0.36

ORIGINAL CONCEPT - CALCULATIONS

(Incremental analysis)
Estimated B/C Ratio for Harrison Ave. P.S.
(single value calculation)

	Total Cost		PWF	EAC	**TOTALS**
First Cost					$4,680,000
Interest lost during construction					$0
					$0
Subtotal					$4,680,000
Equiv. Annual Cost (EAC)	$4,680,000	Times	0.0679139	$317,837	$317,837
O&M Costs					$80,000
Total Annual Costs					$397,837
Total Annual Benefits (See attached)					$187,000
Net Benefits					-$210,837
B/C					0.47

VALUE ENGINEERING STUDY

PROPOSAL NO.: GS-1 & GS-2

PROPOSAL PAGE NO.: 15

ORIGINAL CONCEPT - CALCULATIONS

(incremental analysis)
Estimated B/C Ratio P.S. #7 Upgrade & Oleans Ave. Culvert
(single value calculation)

					TOTALS
First Cost					$31,000,000
Interest lost during 3-yr construction	Spent	Total	Remaining	Interest	
End of Year 1	-$10,333,333	$31,000,000	$20,666,667	$1,343,333	
End of Year 2	-$10,333,333	$20,666,667	$10,333,333	$671,667	
				$2,015,000	$2,015,000
Subtotal					$33,015,000
	Total Cost		PWF	EAC	
Equiv. Annual Cost (EAC)	$33,015,000	Divided by	14.7245200	$2,242,178	$2,242,178
O&M Costs					$8,000
Total Annual Costs					$2,250,178
Total Annual Benefits (See attached)					$2,672,000
Net Benefits					$421,822
B/C					1.19

ORIGINAL CONCEPT - CALCULATIONS

Proposed Alternatives - Subbasin D

- Alternative #4 - Construct 3500 lf 8'x 8' concrete box culvert (cbc) beginning on St.Bernard & St. Claude, continuing to Rampart, then turns onto Rampart and continues westerly to Esplanade Ave. On Esplanade Ave, continues to the Mississippi River. Construct new 250 cfs PS at Esplanade & the River
- Alternative #5 – Construct 2800 lf 8'x 8' cbc on Esplanade Ave, from N. Rampart to the Mississippi River. Construct new 250 cfs PS at Esplanade Ave & the River

ORIGINAL CONCEPT - CALCULATIONS

Preliminary Screening - Subbasin D

- Calculate damages using the hydraulic model output:
  - Estimated Average Annual Damages: $2,100,000
  - Estimated Benefits of Alt. 4: $767,353
  - Estimated Benefits of Alt. 5: $995,123
- Preliminary Screening - assume that a plan can proceed to detailed analysis if the estimated construction cost is less than 10 times the benefits provided by that plan
- Projected cost of plan using benefit calculation: $7,670,000
  - Estimated construction cost of Alt. 4: $15,800,000
- Projected cost of plan using benefit calculation: $9,950,000
  - Estimated construction cost of Alt. 5: $12,600,000
- Preliminary analysis indicates that the benefits provided by the proposed alternatives will not support the cost of the plans.
- Team combined Subbasins D and E into a single hydraulic basin for alternative analysis
- Still under H&H analysis - placing additional cfs at London Ave Canal, PS#4, on Pratt Dr near Prentiss Ave

PROPOSED CONCEPT - CALCULATIONS

(incremental analysis)
Estimated B/C Ratio for Alt #5 (Current configuration)
(single value calculation)

					TOTALS
First Cost					$12,600,000
Interest lost during 3-yr construction	Spent	Total	Remaining	Interest	
End of Year 1	-$4,200,000	$12,600,000	$8,400,000	$546,000	
End of Year 2	-$4,200,000	$8,400,000	$4,200,000	$273,000	
				$819,000	$819,000
Subtotal					$13,419,000
	Total Cost		PWF	EAC	
Equiv. Annual Cost (EAC)	$13,419,000	Divided by	14.7245200	$911,337	$911,337
O&M Costs					$80,000
Total Annual Costs					$991,337
Total Annual Benefits (See attached)					$1,194,000
Net Benefits					$202,663
B/C					1.20

PROPOSED CONCEPT - CALCULATIONS

(Incremental analysis)
Estimated B/C Ratio for Alt #5 (Revised configuration):
(single value calculation)

					TOTALS
First Cost					$10,400,000
Interest lost during 3-yr construction	Spent	Total	Remaining	Interest	
End of Year 1	-$3,466,667	$10,400,000	$6,933,333	$450,667	
End of Year 2	-$3,466,667	$6,933,333	$3,466,667	$225,333	
				$676,000	$676,000
Subtotal					$11,076,000
	Total Cost		PWF	EAC	
Equiv. Annual Cost (EAC)	$11,076,000	Divided by	14.7245200	$752,215	$752,215
O&M Costs					$80,000
Total Annual Costs					$832,215
Total Annual Benefits (See attached)					$1,194,000
Net Benefits					$361,785
B/C					1.43

VALUE ENGINEERING STUDY

PROPOSAL NO.: GS-1 & GS-2

PROPOSAL PAGE NO.: 20

LIFE CYCLE COST ANALYSIS

LIFE CYCLE PERIOD 50 DISCOUNT RATE 6.500%

INITIAL COST ITEMS	USEFUL LIFE (YEARS)	ORIGINAL CONCEPT PRESENT WORTH	PROPOSED CONCEPT PRESENT WORTH
BASE COST	50	$40,000,000	$31,000,000
INTEREST LOST DURING CONSTRUCTION		$2,600,000	$2,015,000
	SUB-TOTAL	$42,600,000	$33,015,000

REPLACEMENT ITEMS OR FUTURE ITEMS FOR OC or PC, OR SALVAGED ITEMS (SV)	YEARS	PRESENT WORTH FACTOR	COST or SALVAGE VALUE (-)	OC or PC	PRESENT WORTH	PRESENT WORTH
PUMP REPLACEMENT *	25	0.20714	$1,500,000	OC	$310,707	
* See page4-8.						
				SUB-TOTAL	$310,707	$0

ANNUAL EXPENDITURES	YEARS	PRESENT WORTH FACTOR	ANNUAL COST	OC or PC	PRESENT WORTH	PRESENT WORTH
O&M (See page 4-8)	50	14.72452	$150,000	OC	$2,208,678	
O&M (See page 4-15)	50	14.72452	$8,000	PC		$117,796
				SUB-TOTAL	$2,208,678	$117,796
				TOTAL PRESENT WORTH	$45,119,385	$33,132,796
				LIFE CYCLE SAVINGS		$11,986,589

CONCRETE BOX CULVERT RECOMMENDATIONS

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO.: C-2B

PROPOSAL PAGE NO.: 1

DESCRIPTION: Replace Orleans Avenue cast-in-place box culvert with arch pipe.

CRITERIA CHALLENGE: No **CRITERIA NO.:**

ORIGINAL CONCEPT: Install approximately 7,000 feet of 11 ft x 22 ft cast-in-place (CIP) reinforced concrete box culvert along Orleans Avenue from the end of existing box culvert from Scott street to Pumping Station No. 7

PROPOSED CONCEPT: Install approximately 7,000 feet of arch pipe (e.g. Con-Span) along Orleans Avenue from the end of existing box culvert from Scott Street to Pumping Station No. 7.

SUMMARY OF COST SAVINGS

	FIRST COST	PRESENT WORTH OF O&M COSTS	CONSTRUCTION SCHED. COST*	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$16,500,000	$0	$1,100,000	$17,600,000
PROPOSED CONCEPT	$15,900,000	$0	$700,000	$15,900,000
SAVINGS	$600,000	$0	$400,000	$1,000,000

* Estimated as the interest lost during construction on the required funds.

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Reduced construction time.
- Better public relations for project sponsors if construction can be completed sooner.
- Deliver project benefits faster.

DISADVANTAGES:

- Possible joint leakage at slab/arch interface.
- Timely shipping scheduling required to minimize lay-down area.

JUSTIFICATION:

This proposal is recommended based on the advantages cited above and the reduced cost.

See discussion.

DISCUSSION

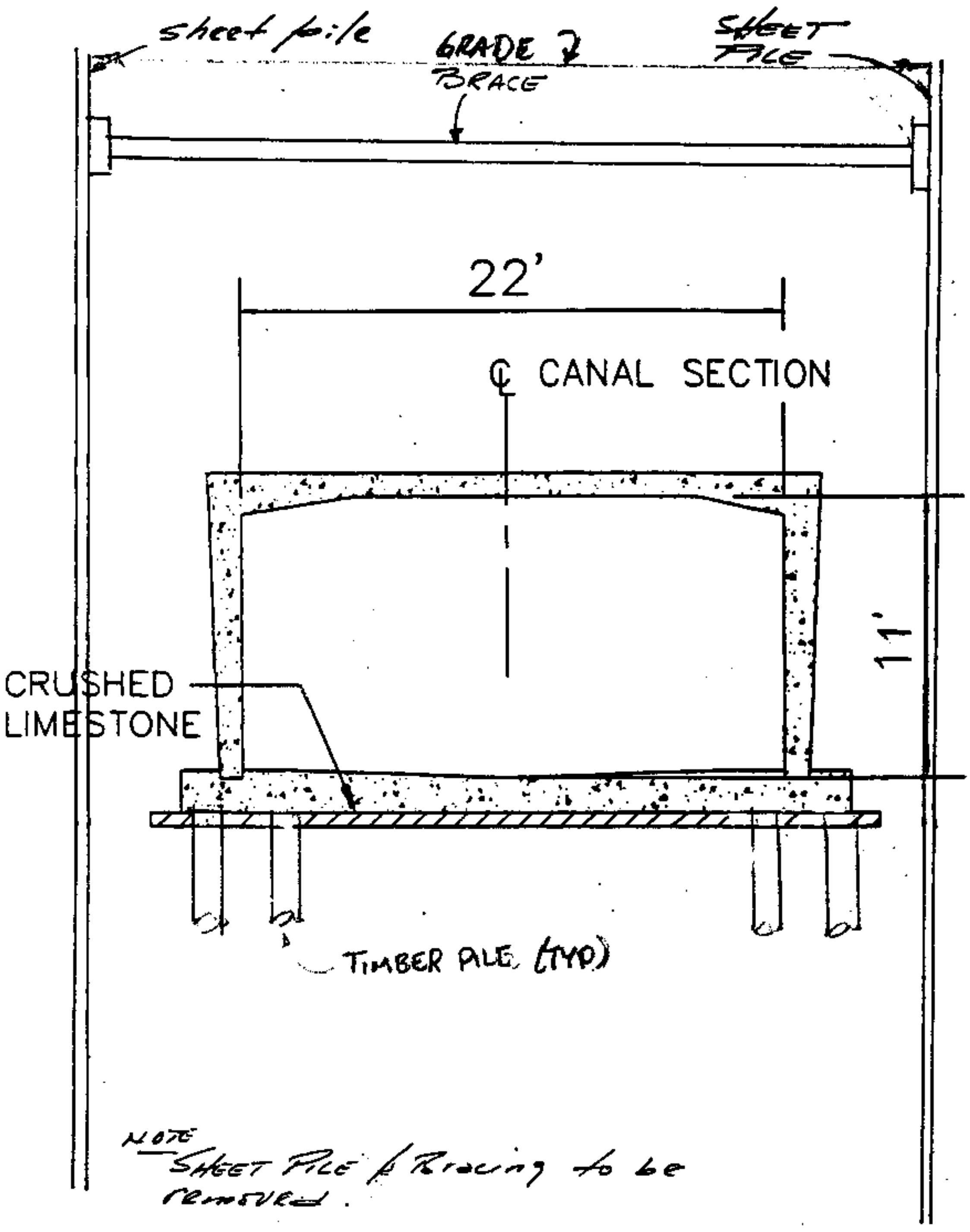
This type of construction is being used to build the Cousin canal in Jefferson Parish per Fritz Fromherz of Bridgetek (504-866-8200)/(504-430-5422) who is the marketing representative for Con-Span for this area. The enclosed Cousin's canal is a 36 ft span by 12.5 ft high. It was an alternative to a cast-in-place four-barrel box culvert. Mr. Fromherz indicated that this type of construction will reduce construction time by at least 25 percent. He also indicated that this type of construction would allow for a larger selection of contractors since they need only to form a base.

This proposal would be even more advantageous if accompanied by a clause in the specifications that provided incentive to the Contractor for early completion.

PROPOSAL NO.:C-2B

PROPOSAL PAGE NO.: 4

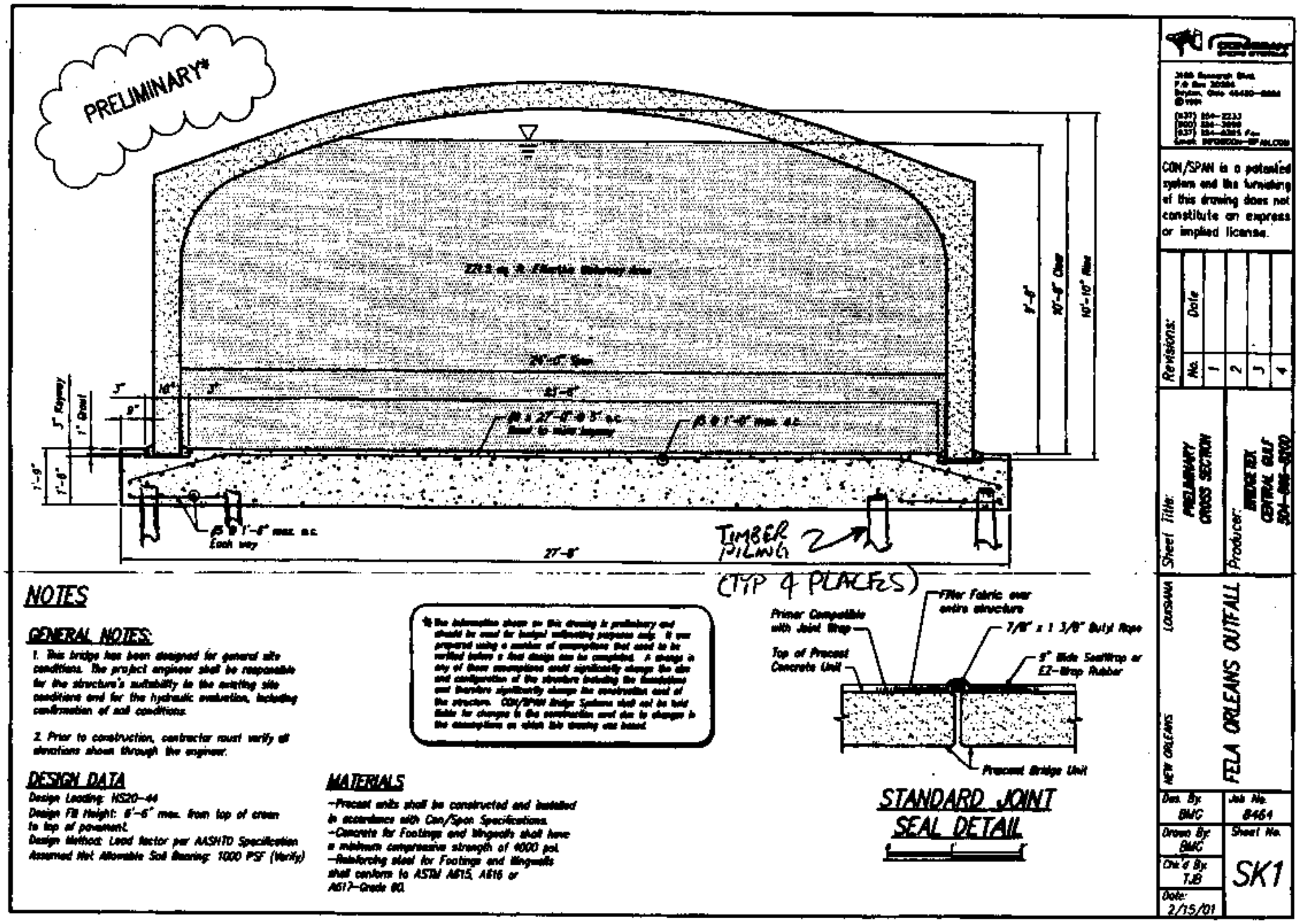
ORIGINAL CONCEPT — SKETCH



PROPOSAL NO.: C-2B

PROPOSAL PAGE NO.: 5

PROPOSED CONCEPT — SKETCH



PROPOSED CONCEPT — INFORMATION

CON/SPAN® BRIDGE SYSTEMS

3100 Research Boulevard
P.O. Box 20266
Dayton, Ohio 45420-0266
(937) 254-2233
(800) 526-3999
Fax: (937) 254-6365
www.con-span.com
bgoldsberry@con-span.com

FAX COVER LETTER
(937) 254-6365

Please deliver the following page(s) to:

NAME: Frank V. **DATE:** 2/15/01

FIRM: Black & Veatch **TIME:** 11:23 AM

CITY/STATE: New Orleans, LA

FAX NUMBER: 504-862-1785

SENDER'S NAME: Tim Beach / Ben Goldsberry

DOCUMENT(S) TRANSMITTED: Fela Orleans Outfall, CON/SPAN #8464

Preliminary cross section

TOTAL NUMBER OF PAGE(S) TRANSMITTED: 1
(NOT INCLUDING THIS PAGE)

COMMENTS: cc: Fritz Fromherz (Bridgetek) speed dial 26

Please refer to Tim Beach of this office for further matters regarding this project.

Call if there any questions. Thanks.

NOTES TO RECIPIENT:

IMPORTANT: Please forward documents to addressee immediately upon receipt. If this transmittal is incomplete or illegible, or if you have any questions concerning received documents please contact us at (937) 254-2233 or (800) 526-3999.

PROPOSED CONCEPT – CALCULATIONS

$$\text{EXCAVATION: } [\overset{\text{Avg. Height}}{11'} + \underset{\text{Slab}}{1.75'} + \underset{\text{Crushed Rock}}{0.5'} + \overset{\text{Soil Cover}}{4'}]\overset{31.67'}{[\underset{\text{Slab Width}}{27.67'} + \underset{\text{Distance BWT Slab \& Sheet Piling}}{(2)(2')}]}(7,000\text{ LF})/27 = 141,636\text{ CY}$$

$$\text{BACKFILL: } 141,636\text{ CY} - [\overset{282.7}{\underset{\text{Arch Volume}}{[11'][25.7']}} + \overset{48.4}{\underset{\text{Base Volume}}{[27.67'][1.75']}}]\ \frac{(7,000LF)}{27} = 55,795\text{ CY}$$

CONCRETE: Base Slab

$[27.67'][1.75'][7,000\text{ LF}]/27 = 12,554\text{ CY}$

CONSTRUCTION SCHEDULE COST (CSC):
If the schedule can be shortened by one year using Con-Span, then the half the interest on the Original Concept represents the cost of an additional year of construction, or:

CSC = ½ x \$16,531,898 x 6 ½ % = \$537,287

PROPOSAL NO.: C-2B

PROPOSAL PAGE NO.: 8

COST SAVINGS ESTIMATE

		Original Concept		Proposed Concept	
Item/Units	Unit Cost	Quantity	Total	Quantity	Total
Excavation (CY)	$6.50	116,970	$760,305	141,636	$920,634
Backfill (CY)	$10.00	51,100	$511,000	55,795	$557,950
Concrete: Base Slab (CY)	$262.00	13,230	$3,466,260	12,554	$3,289,148
Concrete: Walls and Top (CY)	$332.00	20,310	$6,742,920		
Arch Culvert (CON-SPAN) (LF)	$900.00		$0	7,000	$6,300,000
Subtotal			$11,480,485		$11,067,732
Contingencies -20%			$2,296,097		$2,213,546
Subtotal			$13,776,582		$13,281,278
10% E&D			$1,377,658		$1,328,129
10% S&A			$1,377,658		$1,328,129
TOTALS			$16,531,898		$15,937,536
NET SAVINGS					$594,362

All costs from project MCACES Report and MCACES Database except if noted below:

1. Concrete costs include reinforcing costs.
2. Arch culvert in-place cost based on bridge system quote.
3.

COST SAVINGS ESTIMATE

ESTIMATE OF COST FOR TIME OF CONSTRUCTION

Assume 3-year project under Original Concept.					TOTALS
					$16,500,000
Interest cost during 3-yr construction	Spent	Total	Remaining	Interest	
End of Year 1	-$5,500,000	$16,500,000	$11,000,000	$715,000	
End of Year 2	-$5,500,000	$11,000,000	$5,500,000	$357,500	
				$1,072,500	$1,072,500

Assume 2.25 year project under Proposed Concept.					TOTALS
					$16,000,000
Interest cost during 2.25-yr construction	Spent	Total	Remaining	Interest	
End of Year 1	-$7,111,111	$16,000,000	$8,888,889	$577,778	
End of Year 2	-$7,111,111	$8,888,889	$1,777,778	$115,556	
				$693,333	$693,333

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outf

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO.: C-64

PROPOSAL PAGE NO.: 1

CRITERIA CHALLENGE: No **CRITERIA NO.:**

ORIGINAL CONCEPT: Place timber piles under all of the proposed reinforced concrete box culverts for vertical stability of all proposed box culverts.

PROPOSED CONCEPT: Eliminate timber piles under proposed reinforced concrete box culverts.

SUMMARY OF COST SAVINGS

	FIRST COST	PRESENT WORTH OF O&M COSTS	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$2,871,000	$0	$2,871,000
PROPOSED CONCEPT	$1,093,000	$0	$1,093,000
SAVINGS	$1,778,000	$0	$1,778,000

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Reduce construction period.
- Culvert will settle along with surrounding drainage area, thus avoiding the creation of a high point above the pipe.
- Reduce construction noise impact on adjacent community.

DISADVANTAGES:

- Differential settlement is possible

JUSTIFICATION:

This proposal is recommended based on the advantages listed above and the reduced cost.

DISCUSSION

This concept has been successfully accomplished in Jefferson Parish under similar conditions.

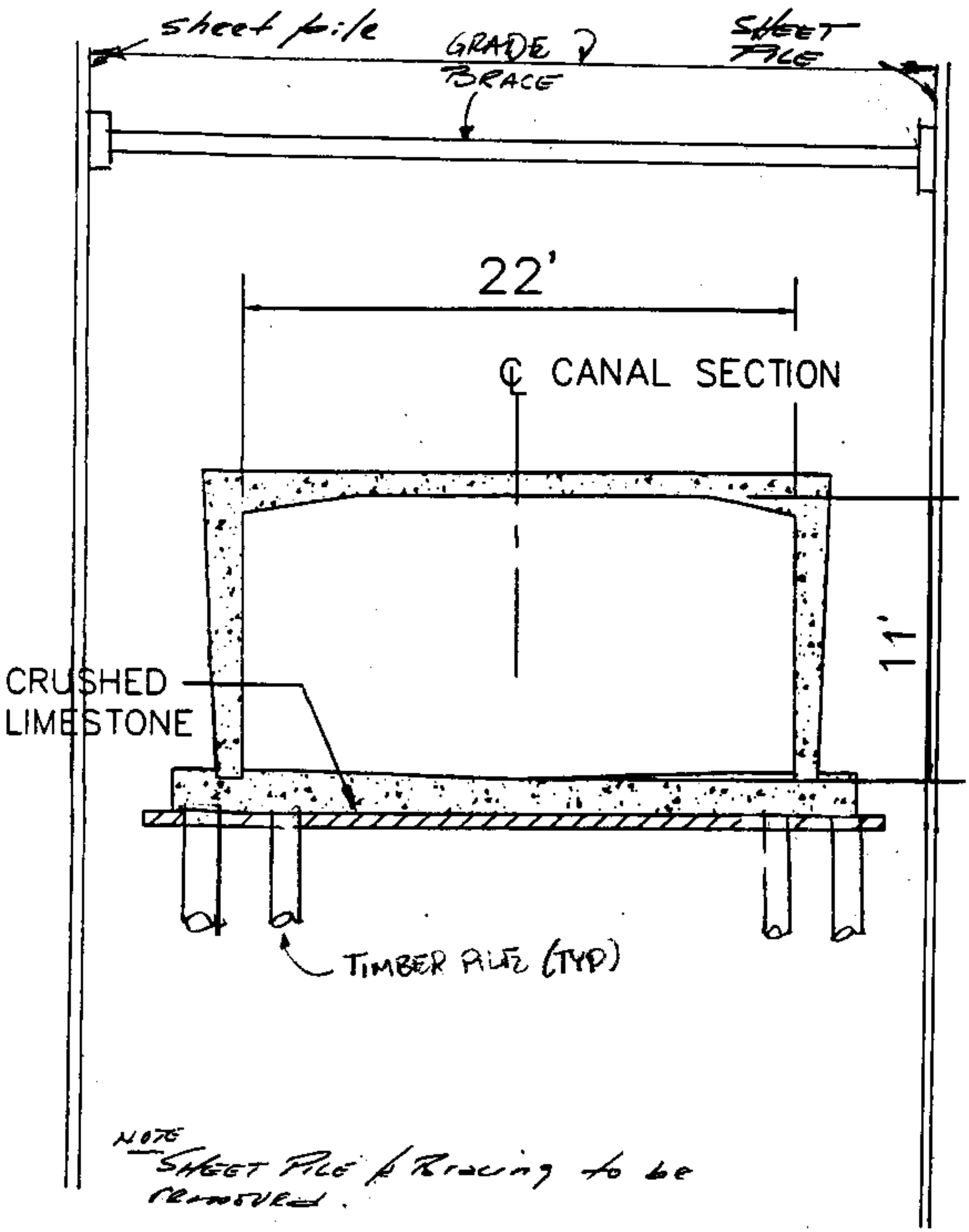
This proposal is based on several assumptions:

- Allowable net bearing pressure of approximately 1,000 psf *
- Backfill unit weight is 125 pcf
- The design groundwater table is at grade and the factor of safety against buoyant uplift is 1.0 or greater.
- The culvert will be tied to existing culvert and pumping station.
- The site will continued to be de-watered until backfill is complete
- A 3 foot thick crushed rock bed is placed under the culvert.
- A geotextile matte is placed under the crushed rock bedding.

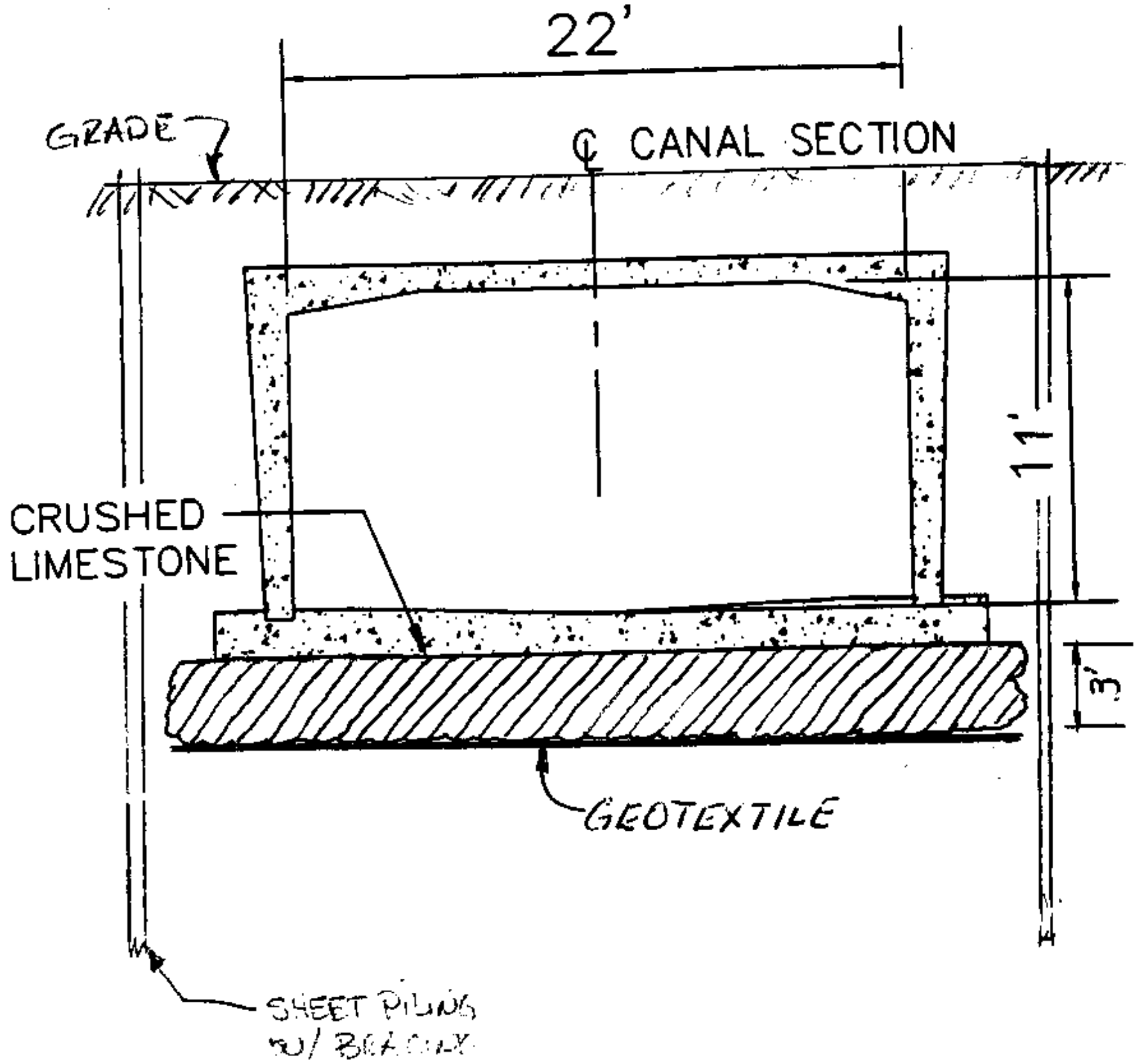
*The actual bearing pressure was later determined to be about 30% of this assumed value. To overcome this lower bearing pressure a 3-foot thick crushed rock layer was placed on a geotextile mat to increase the net bearing pressure under the slab. Prior to adopting this concept, and in-depth analysis of the design would be required.

The original concept of the 11 ft x 22 ft box culvert will resist uplift with a calculated factor of safety against uplift of 1.2. Also the calculated gross bearing pressure is less than the allowable gross bearing pressure. It is assumed that the other culverts performance will be the same.

ORIGINAL CONCEPT — SKETCH



PROPOSED CONCEPT — SKETCH



SCOPE:

Size box culvert to resist uplift and bearing pressure without timber piles

UNITS:

$\mathrm{sind}(x) := \sin\left(x \cdot \frac{\pi}{180 \cdot deg}\right)$ $k := 1000 \cdot lb$ $ksf := \frac{k}{ft^2}$ $kcf := \frac{k}{ft^3}$ $klf := \frac{k}{ft}$ $psf := \frac{lb}{ft^2}$ $psi := 1 \cdot \frac{lb}{in^2}$

$pcf := 1 \frac{lb}{ft^3}$ $cy := 27\ ft^3$

DESIGN INPUT:

Soil Parameters:

Unit Weight of Backfill = $\gamma := 125 \frac{lb}{ft^3}$

Allowable Bearing Pressure = $\sigma_{soilbearing} := 1000\ psf$

Geometry:

Minimum distance from grade to top of box culvert (negative if manhole above grade)= $H_{gmin} := 4\ ft$

Maximum depth from grade to top of box culvert $H_{gmax} := 5\ ft$

Maximum clear width of box culvert = $w_{bc} := 22.0\ ft$

Thickness of box culvert roof = $t_r := 18\ in$

Thickness of box culvert slab = $t_s := 24\ in$

Thickness of box culvert wall = $t_w := 18\ in$

Maximum clear height of manhole = $h_{bc} := 11\ ft$

Distance of slab extending past wall= $a := 3\ in$

Length of culvert $L := 7000\ ft$

PROPOSED CONCEPT — CALCULATIONS

STEP 1: GEOMETRY:

Maximum width of box culvert roof = $w_r := w_{bc} + 2 \cdot t_w$ $\qquad w_r = 25 \cdot ft$

Maximum width of box culvert slab= $w_{slab} := w_r + 2\ a$ $\qquad w_{slab} = 25.5 \cdot ft$

Height of culvert from top of roof to top of bottom slab= $H_{bc} := h_{bc} + t_r$ $\qquad H_{bc} = 12.5 \cdot ft$

STEP 2: BOUYANCY CHECK:

Weight of concrete:

$$P_{concrete} := \left[\left[w_r \cdot H_{bc} - \left(w_r - 2 \cdot t_w\right) \cdot h_{bc}\right] + w_{slab} \cdot t_s\right] \cdot 0.15\ kcf \qquad P_{concrete} = 18.2 \cdot \frac{k}{ft}$$

$$P_{soilheel} := \left(w_{slab} - w_r\right) \cdot \left(H_{bc} + H_{gmin}\right) \cdot \gamma \qquad P_{soilheel} = 1 \cdot \frac{k}{ft}$$

$$P_{soiltop} := \left(\left(w_r \cdot H_{gmin}\right)\right) \cdot \gamma \qquad P_{soiltop} = 12.5 \cdot \frac{k}{ft}$$

$$P_{bouyant} := \left[w_{slab} \cdot \left(H_{bc} + H_{gmin}\right)\right] 0.0624\ kcf \qquad P_{bouyant} = 26.3 \cdot \frac{k}{ft}$$

$$FS := \frac{\left(P_{concrete} + P_{soilheel} + P_{soiltop}\right)}{P_{bouyant}} \qquad FS = 1.21 \quad \text{Ok}$$

STEP 3: BEARING PRESSURE:

$$P_{culvertwater} := w_{bc} \cdot h_{bc} \cdot 0.0624\ kcf \qquad P_{culvertwater} = 15.1 \cdot \frac{k}{ft}$$

$$P_{HS20truck} := 64\ \frac{k}{10\ ft} \qquad P_{HS20truck} = 6.4 \cdot \frac{k}{ft}$$

$$GrossBearing := \frac{\left[P_{concrete} + \left(P_{soilheel} + P_{soiltop}\right) \cdot \frac{H_{gmax}}{H_{gmin}} + P_{culvertwater} + P_{HS20truck}\right]}{w_{slab}}$$

$$GrossBearing = 2221 \cdot psf$$

PROPOSED CONCEPT — CALCULATIONS

Allowable Gross Bearing:

$\sigma_{allowablegrossbearing} := \sigma_{soilbearing} + \gamma \cdot (H_{gmax} + H_{bc} + t_s)$ $\sigma_{allowablegrossbearing} = 3438 \cdot psf$

$Check := if(GrossBearing \le \sigma_{allowablegrossbearing}, \text{"Ok"}, \text{"No Good"})$ $Check = \text{"Ok"}$

STEP 4: QUANTITIES:

Concrete:

$Base := w_{slab} \cdot t_s \cdot L$ $Base = 13222 \cdot cy$

Excavation:

$Excavation := (w_{slab} + 4\ ft) \cdot (H_{bc} + t_s + H_{gmin} + 6\ in) \cdot L$ $Excavation = 145315 \cdot cy$

Crushed Rock:

$Crushrock := (w_{slab} + 4\ ft) \cdot 0.5\ ft \cdot L$ $Crushrock = 3824 \cdot cy$

Backfill:

$Backfill := Excavation - [Base + Crushrock + (w_r \cdot H_{bc}) \cdot L]$ $Backfill = 47250 \cdot cy$

PROPOSAL NO.: C-64

PROPOSAL PAGE NO.: 9

COST SAVINGS ESTIMATE

		Original Concept		Proposed Concept	
Item/Units	Unit Cost	Quantity	Total	Quantity	Total
Timber Piling for 11' x 22' BC	$6.00	280,080	$1,680,480	0	$0
Timber Piling for 10' x 12' BC	$6.00	13,280	$79,680	0	$0
Crushed Limestone (CY)	$30.00	7,800	$234,000	23000	$690,000
Geotextile Fabric (SY)	$3.00			23000	$69,000
Subtotal			$1,994,160		$759,000
Contingencies - 20%			$398,832		$151,800
Subtotal			$2,392,992		$910,800
10% E&D			$239,299		$91,080
10% S&A			$239,299		$91,080
TOTALS			$2,871,590		$1,092,960
NET SAVINGS					$1,778,630

All costs from project MCACES Report and MCACES Database except if noted below:

1.

2.

3.

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO.: C-67

PROPOSAL PAGE NO.: 1

DESCRIPTION: Alternative Splash Protection

CRITERIA CHALLENGE: No **CRITERIA NO.:**

ORIGINAL CONCEPT: The drainage canal downstream from P.S. #2 is open and exposed. Water splashes outside the canal during high flows as a result of water impacting the concrete beam bracing across the top of the canal. Precast concrete panels will be installed to cover the canal and eliminate this problem.

PROPOSED CONCEPT: Provide an alternative means, such as a precast fence; to both prevent water from splashing outside the canal that will also act to prevent anyone from entering the canal.

SUMMARY OF COST SAVINGS

	FIRST COST	PRESENT WORTH OF O&M COSTS	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$1,163,400	$0	$1,163,400
PROPOSED CONCEPT	$403,200	$0	$403,200
SAVINGS	$760,200	$0	$760,200

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Less costly materials used to prevent splashing outside the confines of the canal.
- Lighter weight to install than structural precast panels.
- Canal remains open for inspections and maintenance.
- Panels easily removed for maintenance.
- Improves aesthetics.
- Faster to construct.
- Contractor can use lighter weight equipment; less wear on local roads used to haul equipment.
- Smaller lay-down area needed.
- Minimized damage from surcharging in canal. (Structural precast members covering the canal could be displaced and/or damaged by surcharge conditions.)
- Avoids the problems of structural precast panels falling into, and blocking/damming, the canal if dislodged from their supports during surcharging.
- Repairs from surcharging could be made for less cost.

DISADVANTAGES:

- Some water could splash outside the precast concrete panel fence.
- Debris can be thrown into the canal.
- People can jump over the wall and enter the canal.

JUSTIFICATION:

This proposal is recommended for the advantages listed above and the cost savings.

DISCUSSION

The Original Concept was addressing two concerns:

1. Prevent splashing outside the canal.
2. Improve safety conditions at the canal; i.e., prevent people from entering, or falling, into the canal.

Design of the splash protection system was in the conceptual stage, but structural precast concrete panels were envisioned to be installed across the top of the canal. The anchoring system and jointing system details were not available.

Precast panels installed across the canal will solve both concerns listed, but create some added issues. Surcharging may damage these panels, inspections are much more difficult as is maintenance. Depending on surcharge conditions, precast structural panels could be washed into the canal and create local flooding by damming the canal.

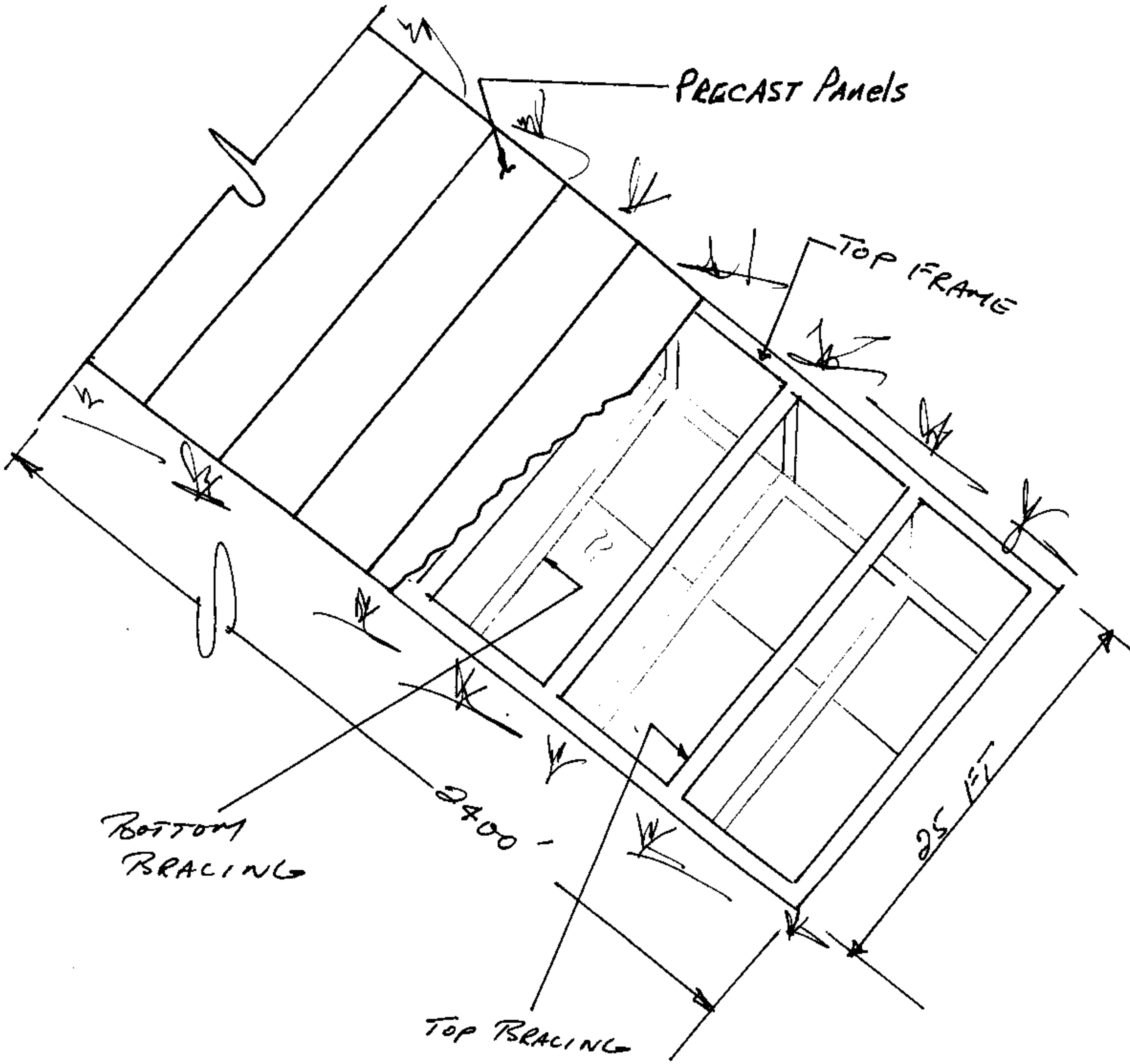
A 6-foot high precast concrete fence may not completely solve the splashing problem but it should significantly reduce the problem and present a substantial barrier to people who want to climb over the wall. When flow in the canal is large enough to cause severe splashing, conditions are more than likely to be very wet everywhere near the canal and a small amount of splashing outside the canal would not be a major concern. New Orleans is a city concerned with its appearance and an aesthetically pleasing precast concrete fence would improve the attractiveness of the canal more than horizontal precast concrete panels. Also, this approach would be less susceptible to damage from surcharging.

A 'post-less' precast fence can be constructed with gates to enable maintenance/inspection access to the canal.

PROPOSAL NO.: C-67

PROPOSAL PAGE NO.: 4

ORIGINAL CONCEPT — SKETCH



PROPOSED CONCEPT — SKETCH

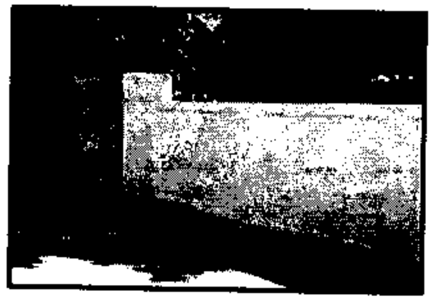
PRECAST CONCRETE PRODUCTS, INC.

4451 8th Avenue South
St. Petersburg, FL 33711
PHONE: 1-800-345-7821
FAX: 727-328-2234
EMAIL: sales@atozprecast.com
URL: www.atozprecast.com

Home Company Profile ▸Products Building Specs Request Information Contact Us

Post Free Fencing

Our post free fencing is constructed with steel reinforced solid precast concrete. This product requires no fence posts; footings and a unique joining system are all that is required. Available in a wide range of lengths, each fence panel is strong, durable, and naturally weather resistant. Customers can choose from a wide variety of textures that can be painted to match any surrounding. Our post free fencing offers an attractive alternative to other forms of fencing. This product is ideal for fencing retailers looking for an attractive, low maintenance, and easy to install product. Please feel free to contact us if you have any questions about this product or its installation.



Points of contact for A-Z are Kirk Grandy or the Owner, Mr. Frank Perry.

PROPOSAL NO.: C-67

PROPOSAL PAGE NO.: 6

COST SAVINGS ESTIMATE

		Original Concept		Proposed Concept	
Item/Units	Unit Cost	Quantity	Total	Quantity	Total
Precast Covers of P.S. #2 Canal (LF)	$346.25	2400	$831,000		
Precast Arch. Fencing of P.S. #2					
Canal (Per LF for 6' high fence)	$60.00			4800	$288,000
Subtotal			$831,000		$288,000
Contingencies - 20%			$166,200		$57,600
Subtotal			$997,200		$345,600
10% E&D			$83,100		$28,800
10% S&A			$83,100		$28,800
TOTALS			$1,163,400		$403,200
NET SAVINGS					$760,200

All costs from project MCACES Report and MCACES Database except if noted below:

1. The precast fence quote from obtained from A-Z Precast from the Owner, Mr. Frank Perry.

2.

3.

ROBERT E. LEE & HARRISON AVENUE PUMPING STATION - RECOMMENDATIONS

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outf

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO.: RPS-1

PROPOSAL PAGE NO.: 1

DESCRIPTION: Replace Vertical Pumps with Submersible Pumps

CRITERIA CHALLENGE: No **CRITERIA NO:**

ORIGINAL CONCEPT: Use two 125 cfs vertical pumps at the Robert E. Lee Pump Station located at the Orleans Canal.

PROPOSED CONCEPT: Use two 125 cfs submersible pumps at the Robert E. Lee Pump Station located at the Orleans Canal.

SUMMARY OF COST SAVINGS

	FIRST COST	PRESENT WORTH OF O&M COSTS	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$1,084,000	$0	$1,084,000
PROPOSED CONCEPT	$1,037,000	$0	$1,037,000
SAVINGS	$47,000	$0	$47,000

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- More aesthetically pleasing solution. (No superstructure and remaining facility is out-of-sight)
- Will eliminate the need/cost for a superstructure.
- Eliminates the possibility of vandalism at the superstructure.
- Eliminates maintenance of a superstructure.
- Off-the-shelf technology with widely proven record of success.
- Individual units are easily replaced when maintenance is needed.
- Will reduce the noise level impact of the pump station on the adjacent community.
- Will have lower installation costs.
- Pumps can be installed more quickly and that will reduce the construction schedule if the pump installation is the schedule critical path.
- Because of fewer wearing parts, maintenance costs will be somewhat reduced and the reliability of the pump station will be higher.
- Local sponsor will become familiar with a new type of pumping equipment that may prove to be the most cost effective, and/or only, solution to future applications.

DISADVANTAGES:

- Local sponsor has strong negative opinions about the O&M of submersible pumps.
- Will require a small housing unit for electrical/control equipment because superstructure has been deleted.
- Pump and motor must be generally removed for maintenance.
- The plan dimension of the pump station may be larger to allow for a properly designed wetwell. This increase in the plan dimension would increase the excavation, backfill, and the substructure concrete quantities.

- The local sponsor not familiar with the operation and maintenance of this type of pumping equipment.
- Because this is a different type of pump, the local sponsor's spare parts inventory will be increased.
- Additional training of the local sponsor's staff will be required to operate and maintain this equipment.

JUSTIFICATION: This alternative has nominal monetary benefits (Approx. $50,000), but is recommended on the basis of the advantages listed and especially the "out-of-sight" aspect that will be particularly appealing to local residents. The advantages appear to outweigh the local sponsor's unfamiliarity with this type of pumping equipment.

DISCUSSION

Submersible pumps are widely used and have a proven record of success this type of application. This type of pump should be considered even though the local sponsor has a preference for vertical type pump units. Refer to Appendix F for information related to submersible pumps that was used in developing this proposal.

The substructure dimensions for the proposed pump station with submersible pumps are very similar to the substructure dimensions for the original vertical pumps. This was roughly checked with the information from the American National Standards Institute for Pump Intake Design (See proposed calculation page.) Thus, the substructure costs for the original and proposed pump concepts are considered essentially equal and there is no cost differential for this item.

A small prefab electrical housing unit will be required for the proposed concept. The cost for this item will be equivalent in cost to the control room that is proposed for the original concept.

The proposed concept does not require a superstructure and the cost for this item can be deleted from the proposed concept.

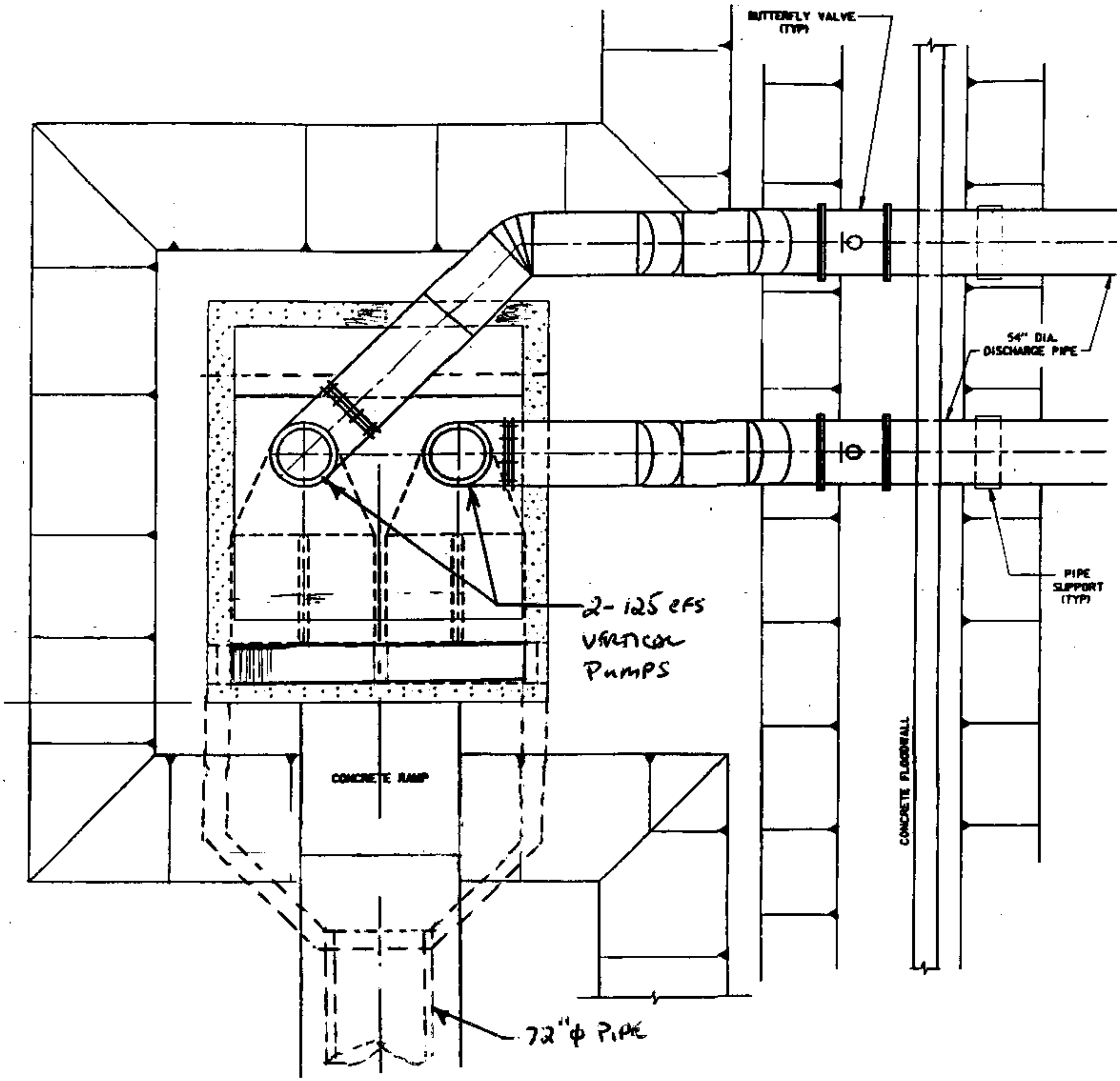
The other major cost item is the installed cost of the two different types of pumps, but the differential is minimal.

VALUE ENGINEERING STUDY

PROPOSAL NO.: RPS-1

PROPOSAL PAGE NO.: 5

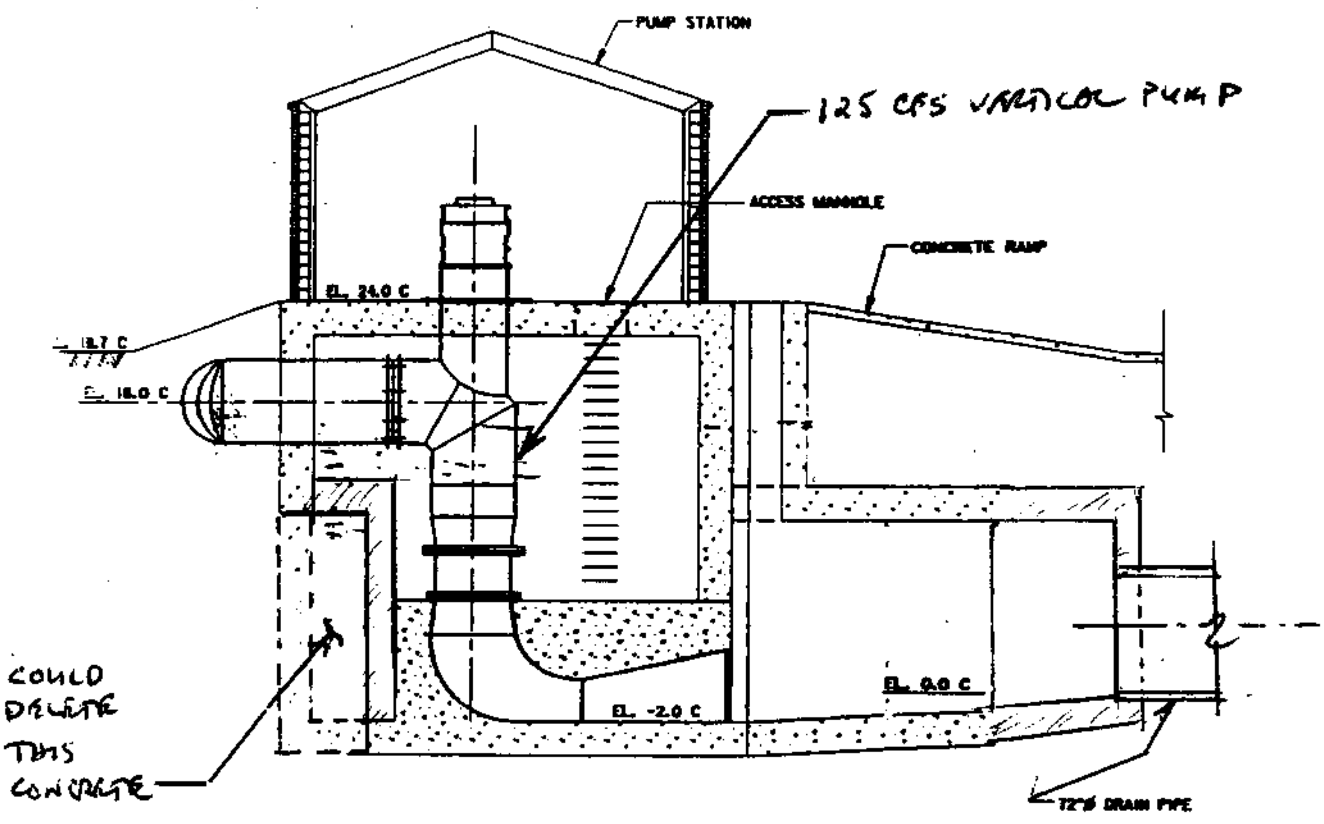
ORIGINAL CONCEPT — SKETCH



PROPOSAL NO.: RPS-1

PROPOSAL PAGE NO.: 6

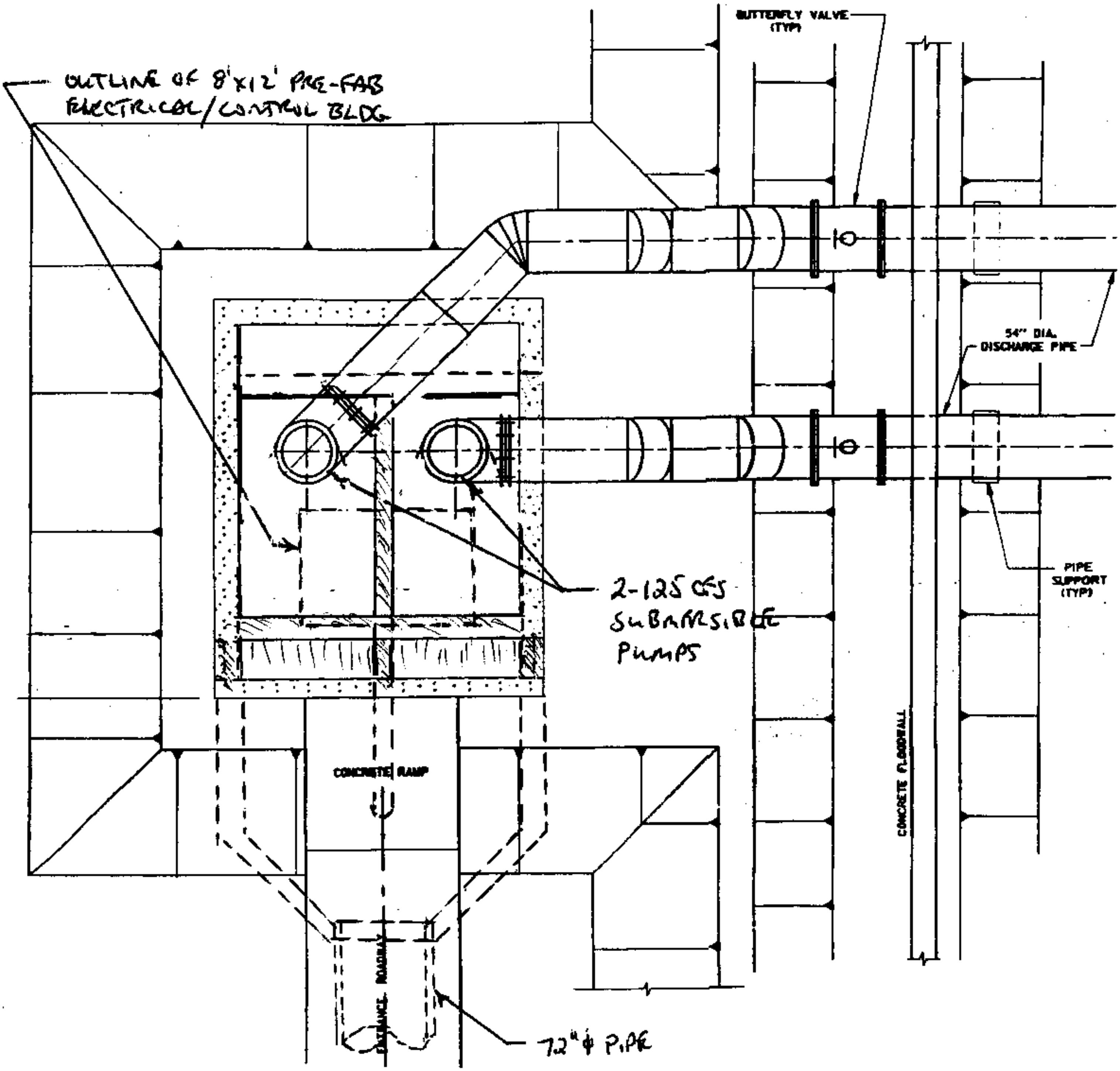
ORIGINAL CONCEPT — SKETCH



TYPICAL SECTION THRU PUMPING STATION

ORIGINAL CONCEPT (ROBERT E. LEE)

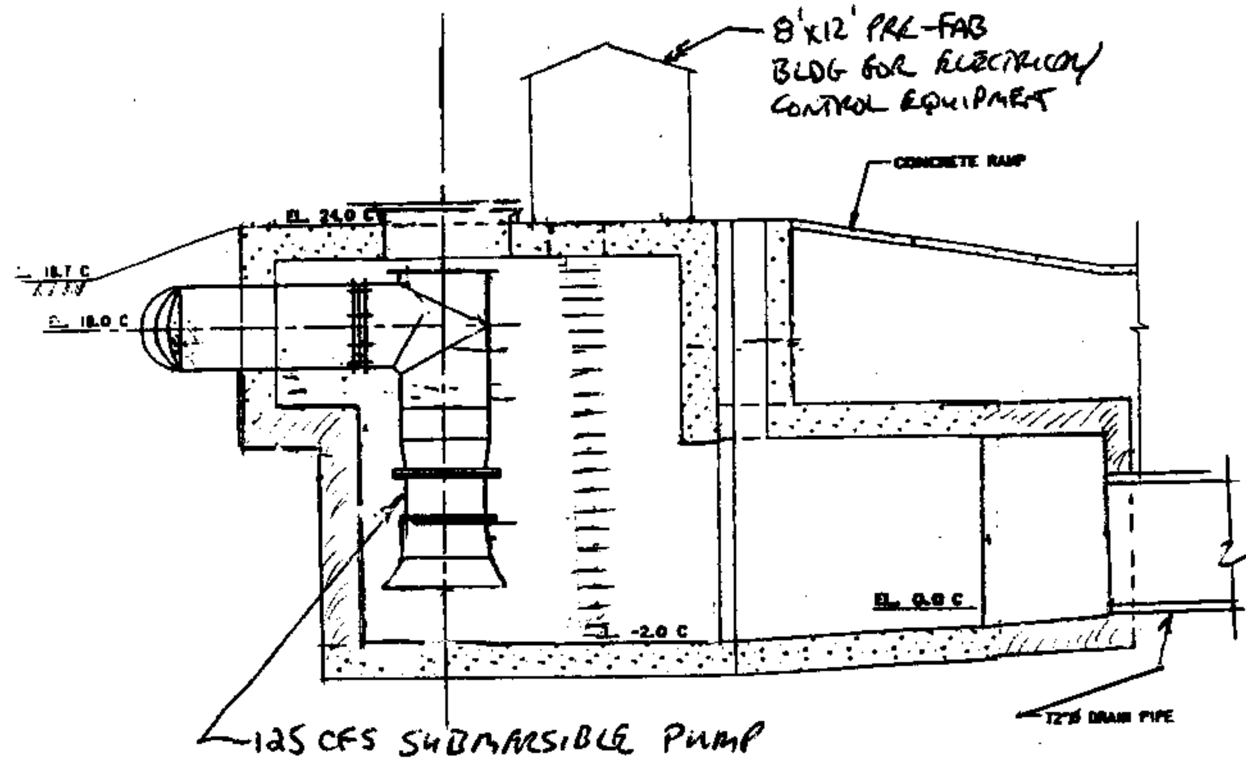
PROPOSED CONCEPT — SKETCH



PROPOSAL NO.: RPS-1

PROPOSAL PAGE NO.: 8

PROPOSED CONCEPT — SKETCH



TYPICAL SECTION THRU PUMPING STATION

PROPOSED CONCEPT (ROBERT E. LEE)

ORIGINAL CONCEPT — CALCULATIONS

From original cost estimate, the cost of the original pump station superstructure is as follows:

Walls:	$18,000
Frame and Roof:	$35,000
Trashracks:	$20,000
Bearing Piles:	$100,000
Total:	$173,800

Superstructure Cost: $18,000 + $35,000 = **$53,000**

Percentage of Superstructure to Total Pumphouse Cost = 53,000/173,800 = 0.30 (30%)

Cost of 125 cfs Vertical Pump from Original Estimate = $350,000/EA

PROPOSED CONCEPT — CALCULATIONS

- Submersible Pump Discharge = 125 CFS = 56,100 GPM
- Assume TDH – 30 feet
- HP = 600
- From Jeff Shelby at Fairbanks and Morris Pumps (913-383-9767) Pump Bowl/Bhu for submersible pump discharge of 125 CFS is 65" diameter.
- From American National Standards Institute (November 17, 1998) for pump intake design, we would have the following pump house dimensions for a wet well for a submersible pump.
- Cost of 125 cfs Submersible Pump = $360,000 (Price from Fairbanks Morse – Telephone: 913-748-4243)

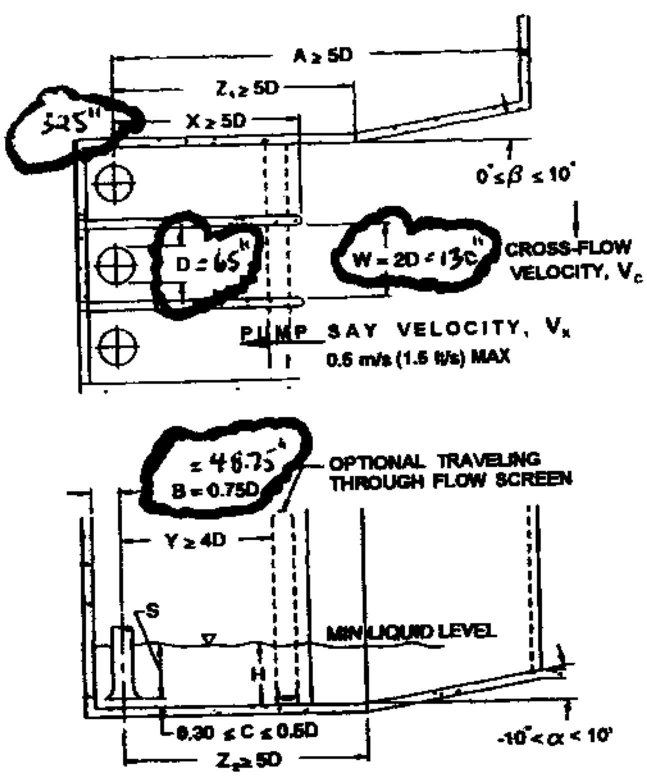


Figure 9.8.1 — Recommended intake structure layout

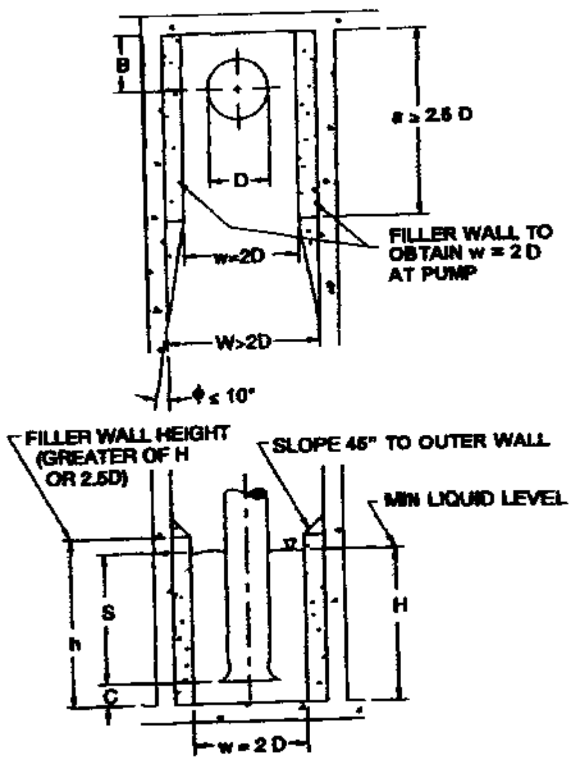


Figure 9.8.2 — Filler wall details for proper bay width

PROPOSAL NO.: RPS-1

PROPOSAL PAGE NO.: 11

COST SAVINGS ESTIMATE

		Original Concept		Proposed Concept	
Item/Units	Unit Cost	Quantity	Total	Quantity	Total
Pump Station Superstructure	$53,000	1	$53,000	0	$0
125 cfs Vertical Pumps	$350,000	2	$700,000	0	$0
125 cfs Submersible Pumps	$360,000	0	$0	2	$720,000
Subtotal			$753,000		$720,000
Contingencies - 20%			$150,600		$144,000
Subtotal			$903,600		$864,000
10% E & D			$90,360		$86,400
10% S & A			$90,360		$86,400
TOTALS			$1,084,320		$1,036,800
NET SAVINGS					$47,520

All costs from project MCACES Report and MCACES Database except if noted below:

1.

2.

3.

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO.: RPS-5A

PROPOSAL PAGE NO.: 1

DESCRIPTION: Locate Submersible Pump Station near Intersection of Argonne and Mouton Streets with a force main to the Orleans Canal

CRITERIA CHALLENGE: No **CRITERIA NO:**

ORIGINAL CONCEPT: Use two 125 CFS vertical pumps at the Robert E. Lee pump station located at the Orleans Canal with a gravity flow, six-foot diameter concrete pipe from the intersection of the intersection of Argonne and Mouton Streets to the pump station.

PROPOSED CONCEPT: Use two 125 CFS submersible pumps at the Robert E. Lee pump station located near the intersection of Argonne and Mouton Streets with a force main directly to the Orleans Canal along Mouton Streee.

SUMMARY OF COST SAVINGS

	FIRST COST	PRESENT WORTH OF O&M COSTS	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$4,685,000	$0	$4,685,000
PROPOSED CONCEPT	$2,508,000	$0	$2,508,000
SAVINGS	$2,177,000	$0	$2,177,000

PROPOSAL NO.: RPS-5A

PROPOSAL PAGE NO: 2

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Will have the same advantages as RPS-1 with regard to using submersible pumps in lieu of vertical pumps.
- Because the force main from the Argonne and Mouton intersection will be smaller in size, and at a shallower depth than the proposed six foot diameter concrete pipe, the quantities and cost of the pipeline installation with regard to excavation, backfill, and pipe will be less.
- Allows the pump station to be moved to the Argonne and Mouton intersection where there is less congestion.
- Corrosion of a concrete force main is less likely than a gravity sewer.
- The cost of easements for the 6-foot diameter force main may be slightly less than for the 9-foot gravity sewer.

DISADVANTAGES:

- Will have the same disadvantages as RPS-1 with regard to using submersible pumps in lieu of vertical pumps.
- Location of pump station is closer in neighborhood.

JUSTIFICATION: This alternative is recommended for implementation because of its potential high cost savings and the advantages listed.

DISCUSSION

The size of the pipeline to the Robert E. Lee Pump Station is too small for the Original Concept. The pipe should have been approximately a 9-foot diameter pipe instead of the 6-foot diameter pipe. The costs for the 9-foot diameter pipe were determined by the ratio of the cost of the 6-foot diameter pipe to the 9-foot diameter pipe. The backfill and excavation quantities were determined similarlyIt should also be noted that the 6 ft diameter pipe for the gravity flow original is slightly undersized and the correct size is closer to 6.5 feet in diameter. However, for purposes of this preliminary evaluation, using a 6-foot diameter pipe is sufficiently accurate.

The force main was sized for 8 fps velocity.

The cost differential for the vertical pumps versus submersible pumps was based on alternative RPS-1.

Use of hydraulic driven pumps may also be practical for this application (See Data in Appendix G.) Hydraulically driven pumping systems are more expensive than conventionally driven systems; however, hydraulic systems allow the equipment/drives to be located several hundred feet from the pumping unit.

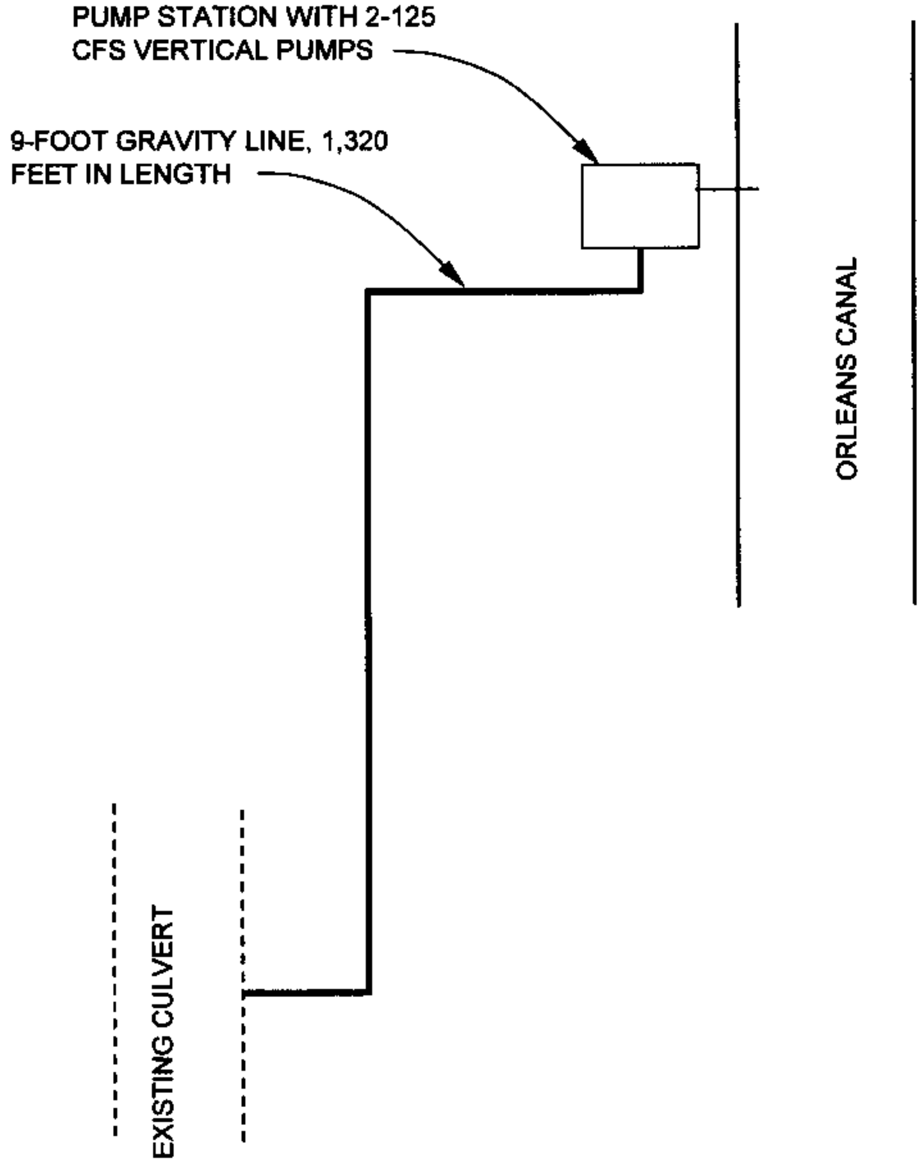
Life cycle costs for the two concepts were determined to be nearly equal. Submersible pumps are more costly to maintain, but there is little in the way of a superstructure to maintain. The 9-foot diameter gravity line for the Original Concept would be more costly to maintain than a 6-foot diameter force main due to it's larger size and the possibility of concrete corrosion.

VALUE ENGINEERING STUDY

PROPOSAL NO.: RPS-5A

PROPOSAL PAGE NO: 4

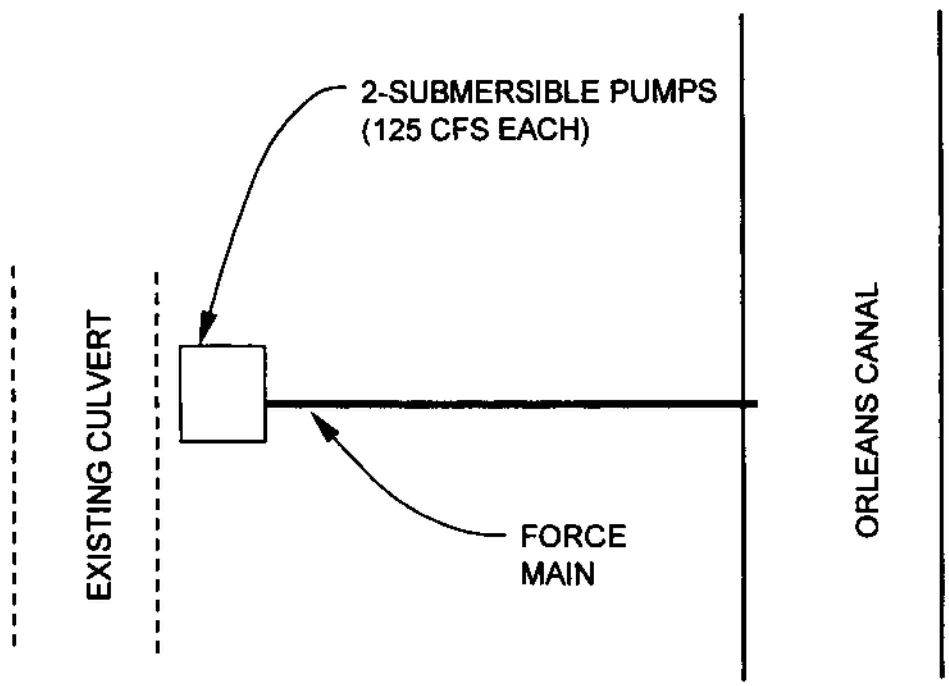
ORIGINAL CONCEPT — SKETCH



PROPOSAL NO.: RPS-5A

PROPOSAL PAGE NO: 5

PROPOSED CONCEPT — SKETCH



ORIGINAL CONCEPT — CALCULATIONS

Determine added cost for using correct pipe size using information from the original estimate (original concept)

Cost	=	1,553,630	→	6" concrete pipe (2,070 LF)
		<u>1,399,693</u>	→	PS (2-125 CFS vertical pumps*
		2,953,323		

NOTE: Original pipe is too small. Resize for 4 FPS velocity.

$$\frac{250}{4} = 62.5\ \text{ft}^2$$

$$D = \frac{\sqrt{62.5 * 4)}}{\pi} = 8.9 \Rightarrow use\ 9.0'\ \phi\ pipe$$

Revise original cost estimate

$$\text{Ratio Pipe}\left(\frac{9.0}{6.0}\right) = 1.5$$

Original Pipe Costs = 486,450

Revised Pipe Costs = 486,450 x 1.5 = $729,675 (Approximate increase of $250,000)

Add 30% more excavation and backfill*, or (65,982 + 79,310) x 0.3 = 43,587 (Use $50,000)

*From original cost estimate for excavation and backfill.

ITEM		COSTS	
Original Cost of 6' diam pipe			$1,553,630
Added cost for 9' diam pipe			<u>$300,000</u>
Total cost for 9' diam pipe (No contingencies)			$1,853,630
Added cost for 9' diam pipe		$300,000	
Contingencies (20%)		<u>$60,000</u>	
	Subtotal	$360,000	
10% E&D		$36,000	
10% S&A		<u>$36,000</u>	
Total cost for 9' diam pipe (With contingencies)			$432,000

PROPOSED CONCEPT — CALCULATIONS

Determine force main size. Use Q = VA

Where:

Q = flow in CFS

V = velocity in fps and,

A = area in sf

Assume V = 8 fps

At Q = 250 CFS, A = 250 / 8 = 31.25 sf

Using A = 31.25, the diameter can be determined to be approximately 6.3 ft (Use 6 feet)

Since the cost from the original estimate was for 6 foot diameter pipe, use that cost for the cost of the force main per lineal foot of pipe; or $1,553,630 / 2,070 = $750 / LF. New length of pipeline directly down Mouton Street to the Orleans Canal $\simeq$ 500 ft.

Determine cost of pump station only:

ITEM	COST
Original cost of PS + Pumps + Superstructure	$1,399,693
Less the cost of the pumps	-$700,000
Less the cost of the superstructure	-$53,000
Cost of submersible pump station	**$646,693**

VALUE ENGINEERING STUDY

PROPOSAL NO.: RPS-5A

PROPOSAL PAGE NO: 8

COST SAVINGS ESTIMATE

Item/Units	Unit Cost	Quantity	Total	Quantity	Total
Original Pipeline (Revised to 9' Dia.)	$1,853,630	1	$1,853,630	0	$0
Original PS Cost (2-125cfs Vert. Pumps)	$1,399,693	1	$1,399,693	0	$0
Proposed Pipeline (6' Dia.) LF	$750	0	$0	500	$375,000
Proposed PS (w/o Pumps and Super.)	$646,693	0	$0	1	$646,693
Proposed 125 cfs Submersible Pumps	$360,000	0	$0	2	$720,000
Subtotal			$3,253,323		$1,741,693
Contingencies - 20%			$650,665		$348,339
Subtotal			$3,903,988		$2,090,032
10% E&D			$390,399		$209,003
10% S&A			$390,399		$209,003
TOTALS			$4,684,785		$2,508,038
NET SAVINGS					$2,176,747

All costs from project MCACES Report and MCACES Database except if noted below:

1.

2.

3.

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO: RPS-5B

PROPOSAL PAGE NO.: 1

DESCRIPTION: Locate Submersible Pump Station near Intersection of Argonne and Mouton Streets with a force main to the Orleans Canal

CRITERIA CHALLENGE: No **CRITERIA NO:**

ORIGINAL CONCEPT: Use two 75 CFS vertical pumps at the Robert E. Lee Pump Station located at the Orleans Canal with a gravity flow, six-foot diameter concrete pipe from the intersection of Argonne and Mouton Streets to the pump station.

PROPOSED CONCEPT: Use two 75 CFS submersible pumps at the Robert E. Lee Pump Station located near the intersection of Argonne and Mouton Streets with a force main to the Orleans Canal.

SUMMARY OF COST SAVINGS

	FIRST COST	PRESENT WORTH OF O&M COSTS	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$3,816,000	$0	$3,816,000
PROPOSED CONCEPT	$1,846,000	$0	$1,846,000
SAVINGS	$1,970,000	$0	$1,970,000

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Will have the same advantages as RPS-1 with regard to using submersible pumps in lieu of vertical pumps.
- Because the force main from the Argonne and Mouton intersection will be smaller in size, and at a shallower depth than the proposed six foot diameter concrete pipe, the quantities and cost of the pipeline installation with regard to excavation, backfill, and pipe will be less.
- Allows the pump station to be moved to the Argonne and Mouton intersection where there is less congestion.
- Corrosion of a concrete force main is less likely than a gravity sewer.

DISADVANTAGES:

- Will have the same disadvantages as RPS-1 with regard to using submersible pumps in lieu of vertical pumps.
- Location of pump station is closer in neighborhood.

JUSTIFICATION: This alternative is recommended for implementation because of its potential high cost savings and the advantages listed.

DISCUSSION

The original concept pipeline to the Robert E. Lee pump station was sized too small for the 250 CFS flow. However, for this alternative, a 7-foot diameter pipe is assumed to be adequate for costing the 150 CFS flow with a 4 fps velocity. Therefore, the cost of the 7-foot diameter pipeline was developed by using the ratio of the diameter of the original 6-foot pipeline to the diameter of a 7-foot pipeline.

The force main was sized for 8 fps velocity.

The cost differential for the vertical pumps versus submersible pumps is similar to alternative RPS-1.

Use of hydraulic driven pumps may also be practical for this application (See Data in Appendix G.) Hydraulically driven pumping systems are more expensive than conventionally driven systems; however, hydraulic systems allow the equipment/drives to be located several hundred feet from the pumping unit.

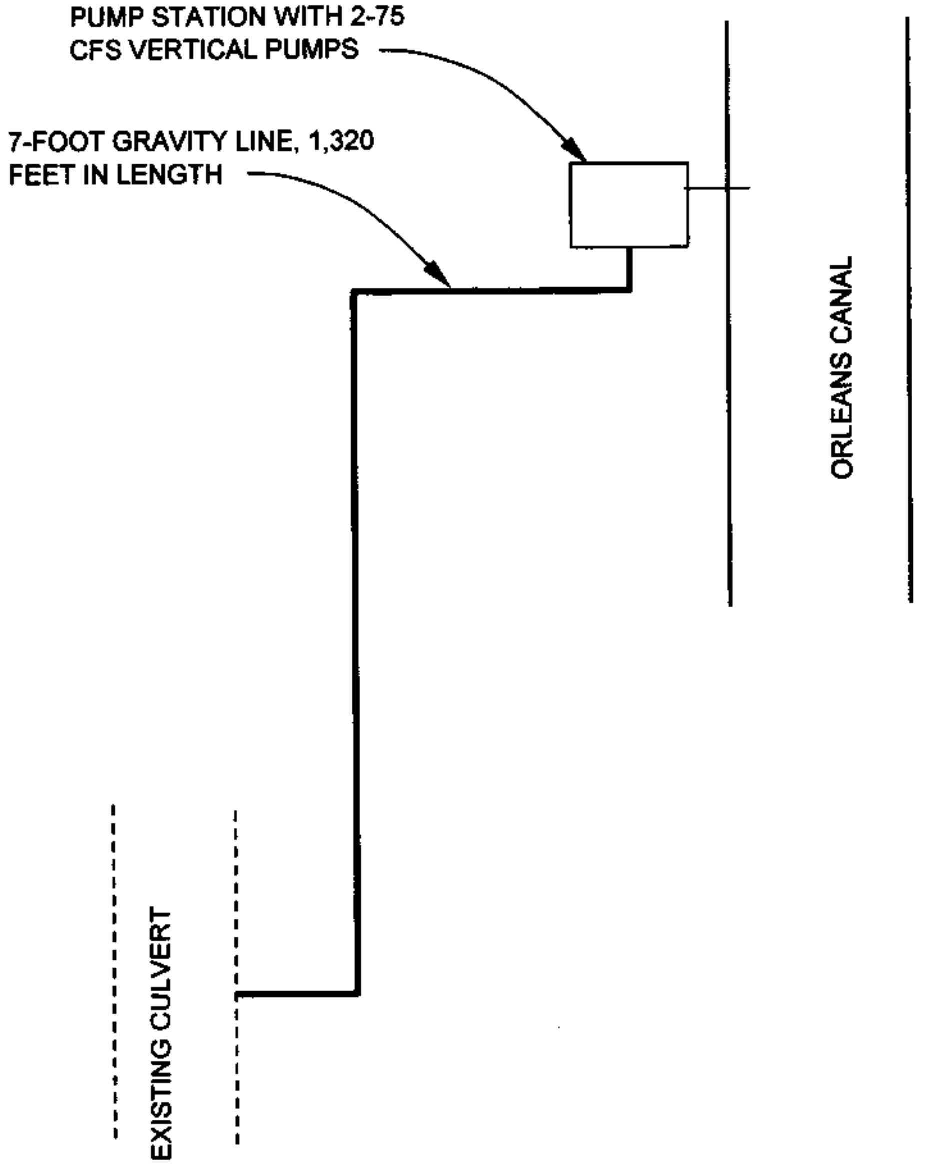
Life cycle costs for the two concepts were determined to be nearly equal. Submersible pumps are more costly to maintain, but there is little in the way of a superstructure to maintain. The 9-foot diameter gravity line for the Original Concept would be more costly to maintain than a 6-foot diameter force main due to it's larger size and the possibility of concrete corrosion.

Life cycle costs for the two concepts were determined to be nearly equal. Submersible pumps are more costly to maintain, but there is little in the way of a superstructure to maintain. The gravity line for the Original Concept would be more costly to maintain than a force main due to it's larger size and the possibility of concrete corrosion.

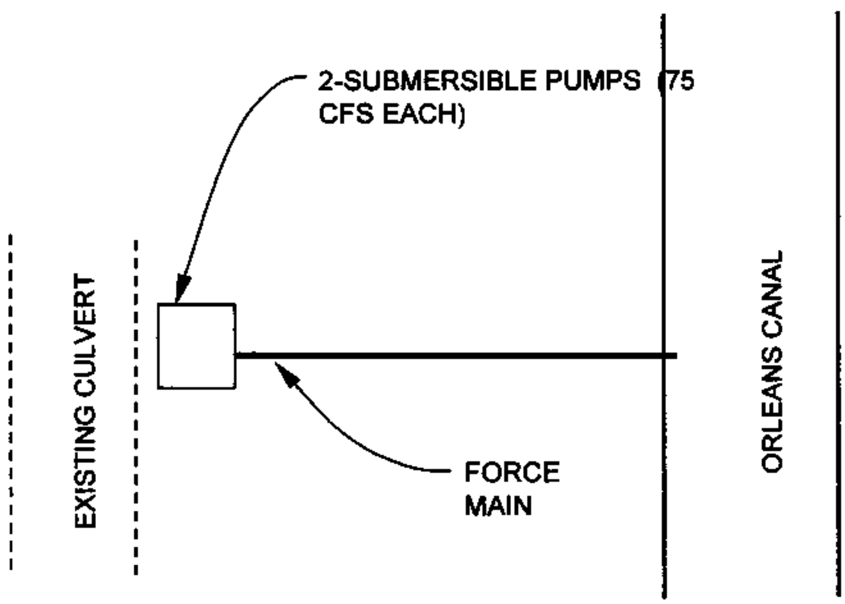
PROPOSAL NO: RPS-5B

PROPOSAL PAGE NO: 4

ORIGINAL CONCEPT — SKETCH



PROPOSED CONCEPT — SKETCH



ORIGINAL CONCEPT — CALCULATIONS

Q = 150 CFS total

Assume gravity flow at approximately 4 fps.

Q = VA

A = Q/A = 150/4 = 37.5 sq. ft.

D = 7.0 ft

Ratio of 7.0 ft to 6.0ft = 7/6 = approx. 15 % (Say 7.5% to account for constant costs such as sheet pile.)

From original cost estimate:

6' Diameter Pipeline = $1,553,630

Therefore, the 7' diameter pipeline cost is $1,553,630 x 1.075 = $1,670,150

Assume 75 CFS vertical pumps are at the ratio of submersible (i.e. 70%)

Thus, estimated cost of 75 CFS vertical pumps are ($350,000 x 0.7) = 245,000

The civil structure portion is also approximately 70% of the 125 CFS pump station cost.

Thus, pump station cost is

($1,399,693 - $700,000 (pump costs)) x 0.7 = $489,785

Add 75 CFS pumps = 489,785 + 2x245,000 = $979,785 (USE $980,000)

Also, assume the superstructure cost is 70% of the 125 CFS superstructure cost. Thus, its cost is ($53,000 x 0.7) = $37,000

Therefore, the pump station w/o pumps and the superstructure is $489,785 - $37,000 = $452,785.

PROPOSED CONCEPT — CALCULATIONS

Force main size at 8 fps for the 150 CFS flow is 5 ft diameter.

This is approximately 7.5% (divide 15% by 2 to account for constant costs such as sheet piling), or 92.5% of the original pipeline cost for a 6 ft diameter pipeline. Thus, the 5 ft diameter pipeline cost is

1,553,630 x 0.92.5 = $1,437,100

Cost of 75 CFS submersible pumps is 70 % of the 125 CFS submersible pump cost.

= 360,000 x 0.7 = $252,000/EA

Since the cost from the original estimate was for 6 foot diameter pipe, use the ratio of that diameter to the diameter of a 5-foot pipe for the cost of the force main per lineal foot of pipe; or ($1,553,630 / 2,070) x 5/6 = $625 / LF. Use $650 / LF. New length of pipeline directly down Mouton Street to the Orleans Canal ≃ 500 ft.

PROPOSAL NO: RPS-5B

PROPOSAL PAGE NO: 8

COST SAVINGS ESTIMATE

		Original Concept		Proposed Concept	
Item/Units	Unit Cost	Quantity	Total	Quantity	Total
Original Pipeline (Revised to 7' Dia.)	$1,670,150	1	$1,670,150	0	$0
Original PS Cost (2-75cfs Vert. Pumps)	$980,000	1	$980,000	0	$0
Proposed Pipeline (5' Dia.)	$650	0	$0	500	$325,000
Proposed PS (w/o Pumps and Super.)	$452,785	0	$0	1	$452,785
Proposed 75 cfs Submersible Pumps	$252,000	0	$0	2	$504,000
Subtotal			$2,650,150		$1,281,785
Contingencies - 20%			$530,030		$256,357
Subtotal			$3,180,180		$1,538,142
10% E&D			$318,018		$153,814
10% S&A			$318,018		$153,814
TOTALS			$3,816,216		$1,845,770
NET SAVINGS					$1,970,446

All costs from project MCACES Report and MCACES Database except if noted below:

1.

2.

3.

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outf

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO.: RPS-8; HPS-1

PROPOSAL PAGE NO.: 1

DESCRIPTION: Reduce Capacity of Robert E. Lee Pumping Station to 150 cfs and Harrison Pumping Station to 250 cfs.

CRITERIA CHALLENGE: No **CRITERIA NO.:**

ORIGINAL CONCEPT:

The capacity of the Robert E. Lee Pumping Station is set at 250 cfs, and the capacity of the Harrison Pumping Station is set at 400 cfs.

PROPOSED CONCEPT:

Reduce the capacities of the Robert E. Lee Pumping Station and Harrison Pumping Station to 150 cfs and 250 cfs respectively, to match the output of the hydraulic model.

SUMMARY OF COST SAVINGS

	FIRST COST	PRESENT WORTH OF O&M COSTS	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$4,521,000	$1,389,000	$5,910,000
PROPOSED CONCEPT	$3,604,000	$1,013,000	$4,617,000
SAVINGS	$917,000	$376,000	$1,293,000

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Reduces the size of the pumping units, discharge piping, and inlet conduit/pipe.
- Siting smaller facilities is easier.

DISADVANTAGES:

- Reduced redundancy.

JUSTIFICATION:

This proposal is recommended because it has lower costs and optimizes size of facilities installed.

DISCUSSION

Costs of facilities are interpolated from costs of original facility by BC&G.

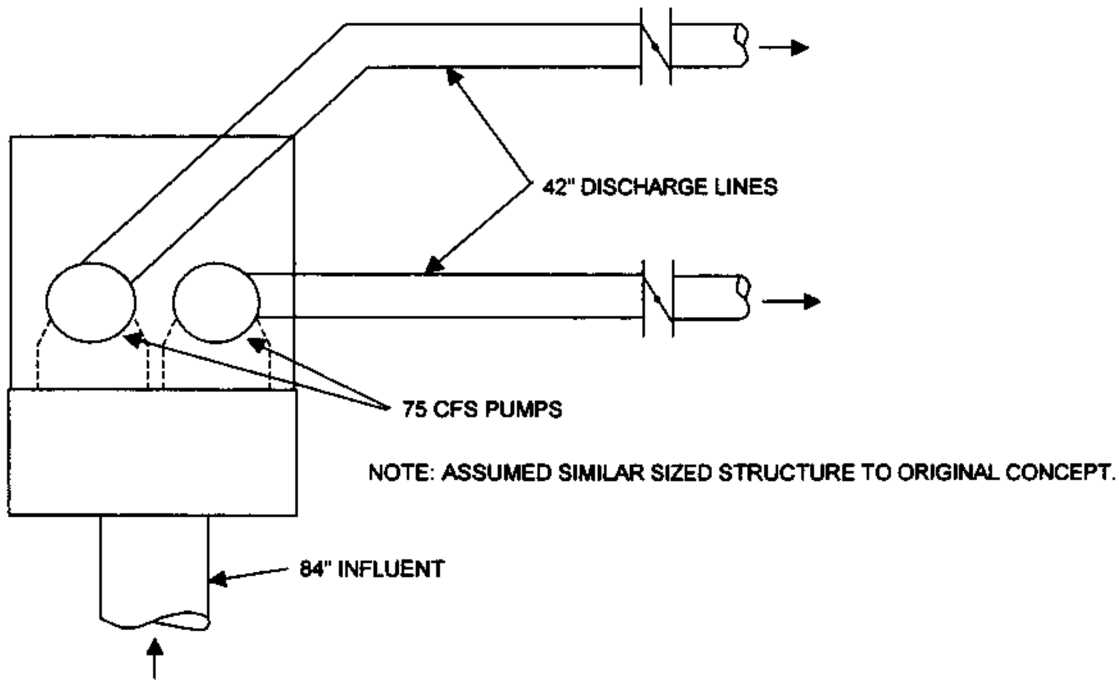
Assume footprint of PS for proposed smaller pumping units is approximately same as for original concept.

Pipe size for original concept of Robert E. Lee P.S. is incorrect. It should have been at least 84-inch diameter, not 72-inch, for a maximum velocity of approximately 6 fps. The reduced size pumping station inlet pipe would 72-inch, so there is no cost difference provided in the cost savings estimate.

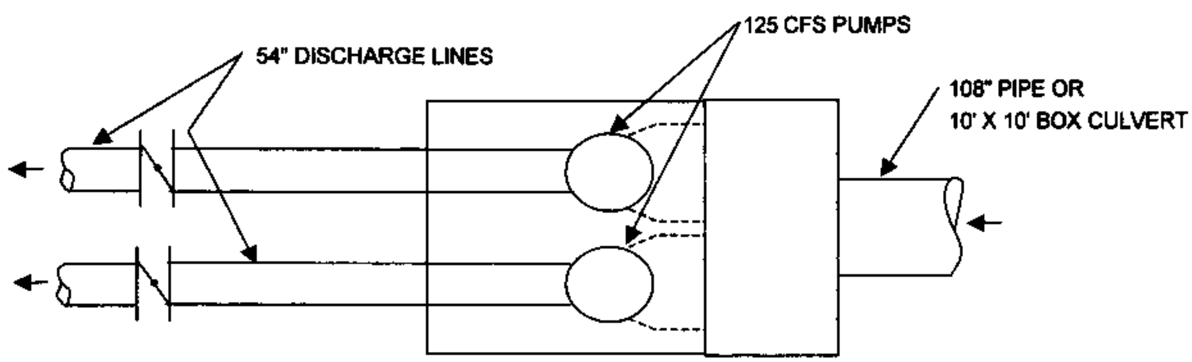
Discussions with the USACE New Orleans District Design Staff indicates that the larger sized stations may not be more effective than a reduced size due inflow constraints.

PROPOSED CONCEPT — SKETCH

ROBERT E. LEE PUMP STATION



HARRISON AVE. PUMP STATION



NOTE: ASSUMED SIMILAR SIZED STRUCTURE TO ORIGINAL CONCEPT.

PROPOSED CONCEPT — CALCULATIONS

Vmax = 8fps for force main:

$$v = \frac{Q}{A}$$

$$\pi\left(\frac{d^2}{4}\right) = \frac{\frac{1}{2}(150)\ cfs}{8\ fps}$$

d ≥ 3.5' ⇒ 42" diam. (Robert E. Lee PS discharge)

$$\pi\left(\frac{d^2}{4}\right) = \frac{\frac{1}{2}(250)\ cfs}{8\ fps}$$

d ≥ 4.5' ⇒ 54" diam. (Harrison PS discharge)

Vmax = 4 fps for gravity flow conduit:

$$\pi\left(\frac{d^2}{4}\right) = \frac{(150)}{4}$$

d ≥ 6.9' ⇒ 84" diam. (Robert E. Lee PS inlet) (Proposed concept ⇒ 72" 0 too small)

$$\pi\left(\frac{d^2}{4}\right) = \frac{(250)}{4}$$

d ≥ 8.9' ⇒ 108" diam. (Harrison PS inlet)

PROPOSAL NO.: RPS-8; HPS-1

PROPOSAL PAGE NO.: 6

COST SAVINGS ESTIMATE

		Original Concept		Proposed Concept	
Item/Units	Unit Cost	Quantity	Total	Quantity	Total
HARRISON AVE. P.S.					
Pumps, 200 cfs (EA)	475,000	2	$950,000		
Pumps, 125 cfs (EA)	350,000			2	$700,000
Discharge Pipe, 60" Steel (LF)	235	160	$37,600		
Discharge Pipe, 54" Steel (LF)	200			160	$32,000
BFV's, 60" (EA)	30,000	2	$60,000		
BFV's, 54" (EA)	24,000			2	$48,000
Box culvert inlet, 10' x 12' (LF)	600	2167	$1,300,200		
Box culvert inlet, 10' x 10' (LF)	600			1950	$1,170,000
ROBERT E. LEE P.S.					
Pumps, 125 cfs (EA)	350,000	2	$700,000		
Pumps, 75 cfs (EA)	240,000			2	$480,000
Discharge Pipe, 54" Steel (LF)	200	160	$32,000		
Discharge Pipe, 42" Steel (LF)	156			160	$24,960
BFV's, 60" (EA)	30,000	2	$60,000		
BFV's, 54" (EA)	24,000			2	$48,000
Subtotal			$3,139,800		$2,502,960
Contingencies			$627,960		$500,592
Subtotal			$3,767,760		$3,003,552
E&D 10%			$376,776		$300,355
S&A 10%			$376,776		$300,355
TOTALS			$4,521,312		$3,604,262
NET SAVINGS					$917,050

All costs from project MCACES Report and MCACES Database except if noted below:

1.

2.

3.

PROPOSAL NO.: RPS-8; HPS-1

PROPOSAL PAGE NO.: 7

LIFE CYCLE COST ANALYSIS

LIFE CYCLE PERIOD 50 DISCOUNT RATE 6.500%

INITIAL COST ITEMS	USEFUL LIFE (YEARS)	ORIGINAL CONCEPT PRESENT WORTH	PROPOSED CONCEPT PRESENT WORTH
Pumps & Valves (HPS)	25	$1,454,400	$1,077,120
Pipe and/or Culverts (HPS)	50	$1,926,432	$1,730,880
Pumps & Valves (RPS)	25	$1,094,400	$760,320
Pipe and/or Culverts (RPS)	50	$46,080	$35,942
	SUB-TOTAL	$4,521,312	$3,604,262

REPLACEMENT ITEMS OR FUTURE ITEMS FOR OC or PC, OR SALVAGED ITEMS (SV)	YEARS	PRESENT WORTH FACTOR	COST or SALVAGE VALUE (-)	OC or PC	PRESENT WORTH	PRESENT WORTH
Pumps & Valves (HPS+RPS)	25	0.20714	$1,454,400	OC	$301,262	
Pumps & Valves (HPS+RPS)	25	0.20714	$1,077,120	PC		$223,112
			SUB-TOTAL		$301,262	$223,112

ANNUAL EXPENDITURES	YEARS	PRESENT WORTH FACTOR	ANNUAL COST	OC or PC	PRESENT WORTH	PRESENT WORTH
Energy at HPS & RPS	50	14.72452	$28,655	OC	$421,931	
Energy at HPS & RPS	50	14.72452	$17,634	PC		$259,652
Maintenance at HPS & RPS	50	14.72452	$45,213	OC	$665,742	
Maintenance at HPS & RPS	50	14.72452	$36,043	PC		$530,710

SUB-TOTAL	$1,087,673	$790,363
TOTAL PRESENT WORTH	$5,910,246	$4,617,737
LIFE CYCLE SAVINGS		$1,292,509

ORIGINAL CONCEPT - PUMPING COST CALCULATIONS

Name of Pumping Unit(s): HPS
Number of Pumps (total): 2
Maximum discharge (each): 200 cfs

Enter the variables as indicated and the annual pumping costs will be calculated.
Do not enter values in colored cells; those cells contain formulae.

			UNITS			
VARIABLES	**gpm**	**mgd**	**bpd (55 gal)**	**cfs**	**l/s**	**bpd (42 gal)**
System Flow (enter one)				400.000		
Flow =	**179,520**	**258.509**	**4,700,157**	**400.330**	**11,328**	**6,154,933**

	Head (ft)	**Pressure (psi)**
System Head (enter one)	15.00	
Head =	**15.00**	**6.50**

	Percent
Percent Time Pumping	5.0%

	Percent
Motor Efficiency (M. eff)	98.000%
Pump Efficiency (P. eff)	90.000%
Other Efficiency	
Total Efficiency (T. eff) =	88.200%

	$/kW-Hr.
Energy Costs	$0.07

Annual Pumping Costs =	**$17,634**	= kW-Hrs x $/kW-Hrs
Annual kW-Hr =	**251,914.2**	= (1.65024 x gpm x head x %time) / T. eff
Water Horsepower =	**680.00**	= (gpm x head) / 3960
Brake Horsepower =	**755.56**	= (gpm x head) / (3960 x P. eff)
Input Horsepower =	**770.98**	= BHP / M. eff

ORIGINAL CONCEPT - PUMPING COST CALCULATIONS

Name of Pumping Unit(s): RPS
Number of Pumps (total): 2
Maximum discharge (each): 125 cfs

Enter the variables as indicated and the annual pumping costs will be calculated.
Do not enter values in colored cells; those cells contain formulae.

			UNITS			
VARIABLES	**gpm**	**mgd**	**bpd (55 gal)**	**cfs**	**l/s**	**bpd (42 gal)**
System Flow (enter one)				250.000		
Flow =	**112,200**	**161.568**	**2,937,598**	**250.206**	**7,080**	**3,846,833**

	Head (ft)	**Pressure (psi)**
System Head (enter one)	15.00	
Head =	**15.00**	**6.50**

	Percent
Percent Time Pumping	5.0%

	Percent
Motor Efficiency (M. eff)	98.000%
Pump Efficiency (P. eff)	90.000%
Other Efficiency	
Total Efficiency (T. eff) =	88.200%

	$/kW-Hr.
Energy Costs	$0.07

Annual Pumping Costs =	**$11,021**	= kW-Hrs x $/kW-Hrs
Annual kW-Hr =	**157,446.4**	= (1.65024 x gpm x head x %time) / T. eff
Water Horsepower =	**425.00**	= (gpm x head) / 3960
Brake Horsepower =	**472.22**	= (gpm x head) / (3960 x P. eff)
Input Horsepower =	**481.86**	= BHP / M. eff

PROPOSED CONCEPT - PUMPING COST CALCULATIONS

Name of Pumping Unit(s): HPS
Number of Pumps (total): 2
Maximum discharge (each): 125

Enter the variables as indicated and the annual pumping costs will be calculated.
Do not enter values in colored cells; those cells contain formulae.

			UNITS			
VARIABLES	**gpm**	**mgd**	**bpd (55 gal)**	**cfs**	**l/s**	**bpd (42 gal)**
System Flow (enter one)				250.000		
Flow =	**112,200**	**161.568**	**2,937,598**	**250.206**	**7,080**	**3,846,833**

	Head (ft)	**Pressure (psi)**
System Head (enter one)	15.00	
Head =	**15.00**	**6.50**

	Percent
Percent Time Pumping	5.0%

	Percent
Motor Efficiency (M. eff)	98.000%
Pump Efficiency (P. eff)	90.000%
Other Efficiency	
Total Efficiency (T. eff) =	88.200%

	$/kW-Hr.
Energy Costs	$0.07

Annual Pumping Costs = **$11,021** = kW-Hrs x $/kW-Hrs

Annual kW-Hr = **157,446.4** = (1.65024 x gpm x head x %time) / T. eff

Water Horsepower = **425.00** = (gpm x head) / 3960

Brake Horsepower = **472.22** = (gpm x head) / (3960 x P. eff)

Input Horsepower = **481.86** = BHP / M. eff

PROPOSED CONCEPT - PUMPING COST CALCULATIONS

Name of Pumping Unit(s): RPS
Number of Pumps (total): 2
Maximum discharge (each): 75

Enter the variables as indicated and the annual pumping costs will be calculated.
Do not enter values in colored cells; those cells contain formulae.

	UNITS					
VARIABLES	**gpm**	**mgd**	**bpd (55 gal)**	**cfs**	**l/s**	**bpd (42 gal)**
System Flow (enter one)				150.000		
Flow =	**67,320**	**96.941**	**1,762,559**	**150.124**	**4,248**	**2,308,100**

	Head (ft)	**Pressure (psi)**
System Head (enter one)	15.00	
Head =	**15.00**	**6.50**

	Percent
Percent Time Pumping	5.0%

	Percent
Motor Efficiency (M. eff)	98.000%
Pump Efficiency (P. eff)	90.000%
Other Efficiency	
Total Efficiency (T. eff) =	88.200%

	$/kW-Hr.
Energy Costs	$0.07

Annual Pumping Costs = **$6,613** = kW-Hrs x $/kW-Hrs

Annual kW-Hr = **94,467.8** = (1.65024 x gpm x head x %time) / T. eff

Water Horsepower = **255.00** = (gpm x head) / 3960

Brake Horsepower = **283.33** = (gpm x head) / (3960 x P. eff)

Input Horsepower = **289.12** = BHP / M. eff

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO: RPS-19

PROPOSAL PAGE NO: 1

DESCRIPTION: Use Single Pump

CRITERIA CHALLENGE: No **CRITERIA NO:**

ORIGINAL CONCEPT: Use two 125 cfs pumps to remove additional collected water.

PROPOSED CONCEPT: Use of one 250 cfs pump to remove additional collected water.

SUMMARY OF COST SAVINGS

	FIRST COST	PRESENT WORTH OF O&M COSTS	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$1,951,000	$510,000	$2,461,000
PROPOSED CONCEPT	$1,590,000	$413,000	$2,003,000
SAVINGS	$361,000	$97,000	$458,000

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Fewer pumps to maintain; reduces O&M costs.
- Expedites construction.
- Smaller station structure.
- Simpler system.
- Less spare parts and inventory.

DISADVANTAGES:

- No back-up in case of failure (contingency).
- May require higher flow to kick-in.
- More draw down on electrical system.

JUSTIFICATION:

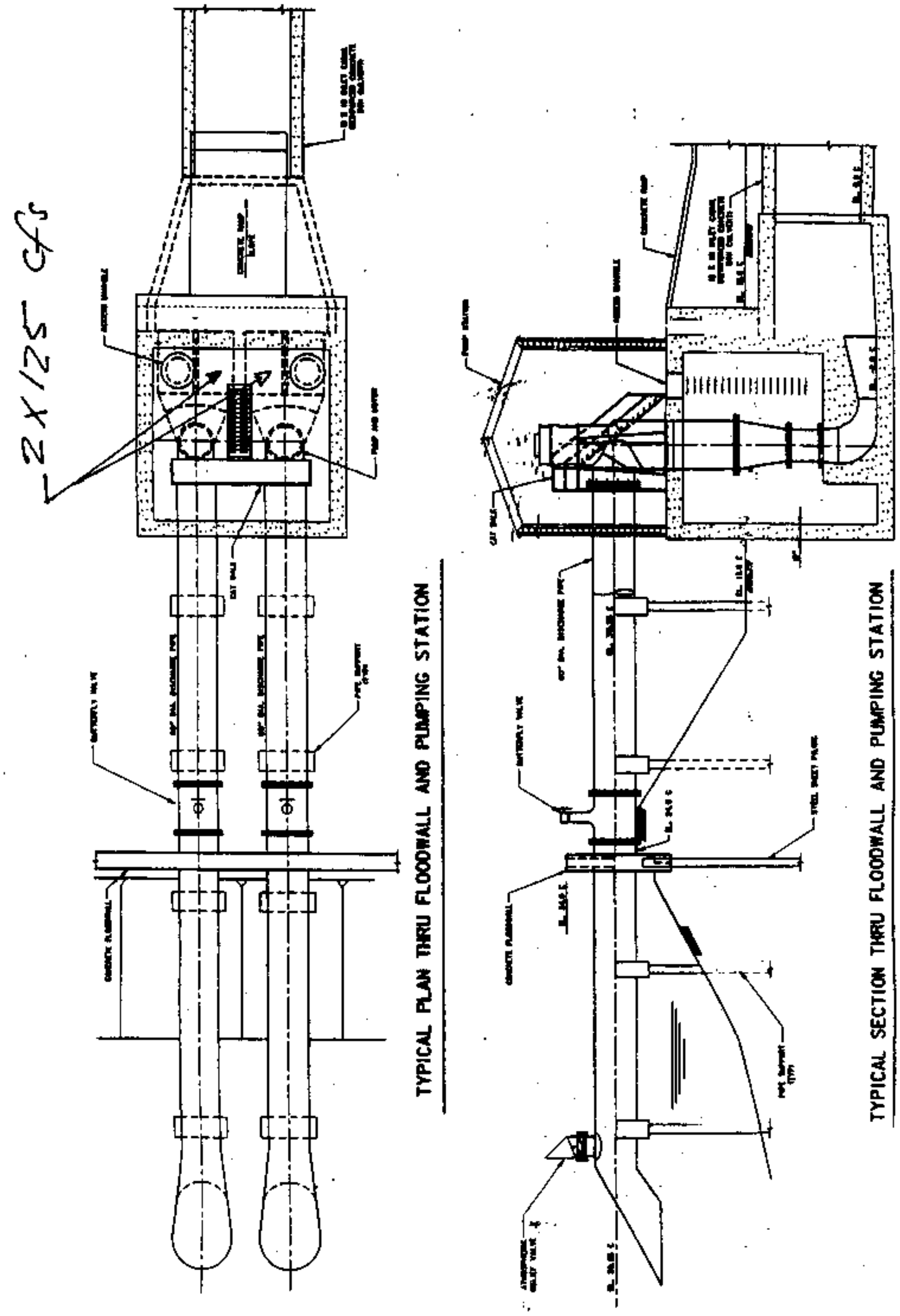
This proposal is recommended based on the advantages listed above and the cost savings.

DISCUSSION

A major concern of this proposal is the apparent reliance on a single pumping unit to satisfy the required function. However, since this station is supplemental to a larger system, unit redundancy is ***not*** critical. Additionally, statistical analysis of rotating machinery substantiates that fewer units reduces the number of outages and increases the on-line availability and the reliability of the system.

The Life Cycle Cost calculations did not consider energy costs since equal volumes of water would be moved, nearly equal amounts of energy would be required to move the water. O&M costs are based on 1% of the cost of the first cost items listed.

ORIGINAL CONCEPT — SKETCH

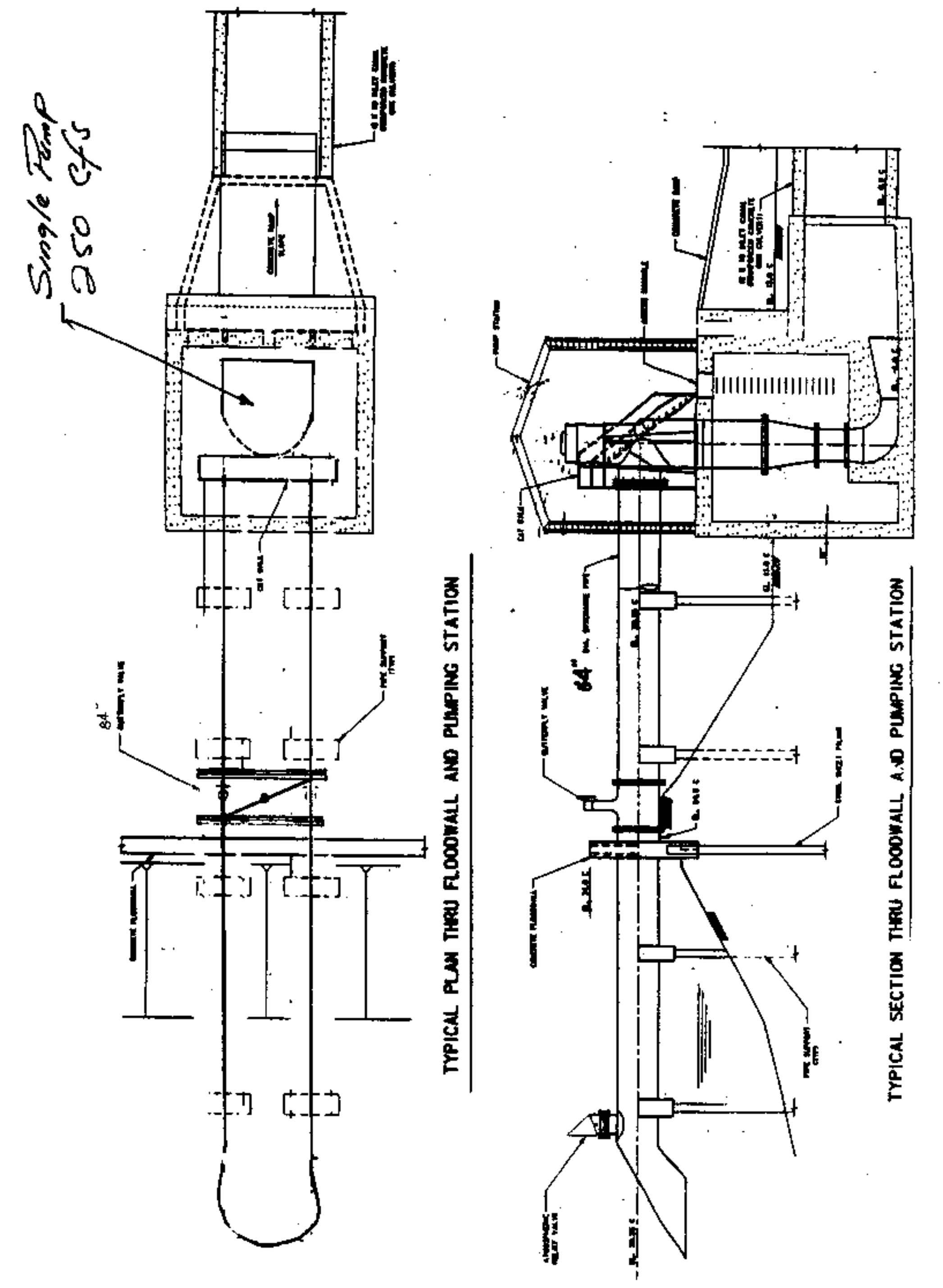


VALUE ENGINEERING STUDY

PROPOSAL NO: RPS-19

PROPOSAL PAGE NO: 5

PROPOSED CONCEPT — SKETCH



ORIGINAL CONCEPT — CALCULATIONS

1.	Cost of 125 cfs pumps	=	$350,000 (each)
2.	Other costs (excluding Mob/Demob)	=	$551,693 (ls)
3.	Cost of 60-inch butterfly valves	=	$30,000 (each)

PROPOSED CONCEPT — CALCULATIONS

1.	Cost of 250 cfs pump	=	$550,000 (each)
2.	Other costs (excluding Mob/Demob)	=	0.85 x $551,693 = $468,939 (ls)
3.	Cost of 84-inch butterfly valve	=	$50,000 (Price quote from Pratt/Keystone for steel flanged valve)

PROPOSAL NO: RPS-19

PROPOSAL PAGE NO: 8

COST SAVINGS ESTIMATE

		Original Concept		Proposed Concept	
Item/Units	Unit Cost	Quantity	Total	Quantity	Total
Pumps, ea. 125 cfs	$350,000	2	$700,000	0	$0
Pumps, ea. 250 cfs	$550,000		$0	1	$550,000
Mob/Demob Costs, LS	$551,693	1	$551,693	1	$468,939
Butterfly Valves, 60" ea.	$24,000	2	$48,000	0	$0
Butterfly Valve, 84" ea.	$50,000		$0	1	$50,000
Pipe, 60", LF	$235	234	$54,990		
Pipe, 84", LF	$300		$0	117	$35,100
Subtotal			$1,354,683		$1,104,039
Contingencies - 20%			$270,937		$220,808
Subtotal			$1,625,620		$1,324,847
10% E & D			$162,562		$132,485
10% S & A			$162,562		$132,485
TOTALS			$1,950,744		$1,589,816
NET SAVINGS					$360,927

All costs from project MCACES Report and MCACES Database except if noted below:

1. 84" BFV quote from local supplier
2. 84" pipe costs by interpolation
3.

PROPOSAL NO: RPS-19

PROPOSAL PAGE NO: 9

LIFE CYCLE COST ANALYSIS

LIFE CYCLE PERIOD 50 DISCOUNT RATE 6.500%

INITIAL COST ITEMS	USEFUL LIFE (YEARS)	ORIGINAL CONCEPT PRESENT WORTH	PROPOSED CONCEPT PRESENT WORTH
Pumps & Valves	25	$1,077,120	$864,000
Pipe	50	$79,186	$50,544
Mob/Demob	50	$794,438	$675,272
	SUB-TOTAL	$1,950,744	$1,589,816

REPLACEMENT ITEMS OR FUTURE ITEMS FOR OC or PC, OR SALVAGED ITEMS (SV)	YEARS	PRESENT WORTH FACTOR	COST or SALVAGE VALUE (-)	OC or PC	PRESENT WORTH	PRESENT WORTH
Pumps & Valves	25	0.20714	$1,077,120	OC	$223,112	
Pump & Valve	25	0.20714	$864,000	PC		$178,967
				SUB-TOTAL	$223,112	$178,967

ANNUAL EXPENDITURES	YEARS	PRESENT WORTH FACTOR	ANNUAL COST	OC or PC	PRESENT WORTH	PRESENT WORTH
O&M	50	14.72452	$19,507	OC	$287,238	
O&M	50	14.72452	$15,898	PC		$234,093
				SUB-TOTAL	$287,238	$234,093
				TOTAL PRESENT WORTH	$2,461,094	$2,002,876
				LIFE CYCLE SAVINGS		$458,218

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO.: RPS-39

PROPOSAL PAGE NO.: 1

DESCRIPTION: Replace concrete pipe near Robert E Lee pumping station with alternative pipe material.

CRITERIA CHALLENGE: No **CRITERIA NO.:**

ORIGINAL CONCEPT: Install approximately 2070 lf of 6 ft diameter concrete pipe near Robert E. Lee pumping station.

PROPOSED CONCEPT: Install approximately 2070 lf of 6ft diameter HDPE pipe near the Robert E. Lee pumping station.

SUMMARY OF COST SAVINGS

	FIRST COST	PRESENT WORTH OF O&M COSTS	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$873,000	$0	$873,000
PROPOSED CONCEPT	$843,000	$0	$843,000
SAVINGS	$30,000	$0	$30,000

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Long service even in corrosive environments.
- Excellent hydraulic characteristics
- Installation is easier due to lightweight/long length with fewer joints to assemble
- Rugged handling performance
- Delivers project benefits faster.
- Able to withstand settlement, uplift, and side-forces better than rigid conduits such as concrete pipe.
- Lighter weight pipe will result in less overall settlement.

DISADVANTAGES:

- Will need to increase anchorage requirements vertically to resist uplift because HDPE is a lighter material than concrete pipe. (Both pipes will float if empty and the water elevation is sufficiently high enough above the top of pipe.)

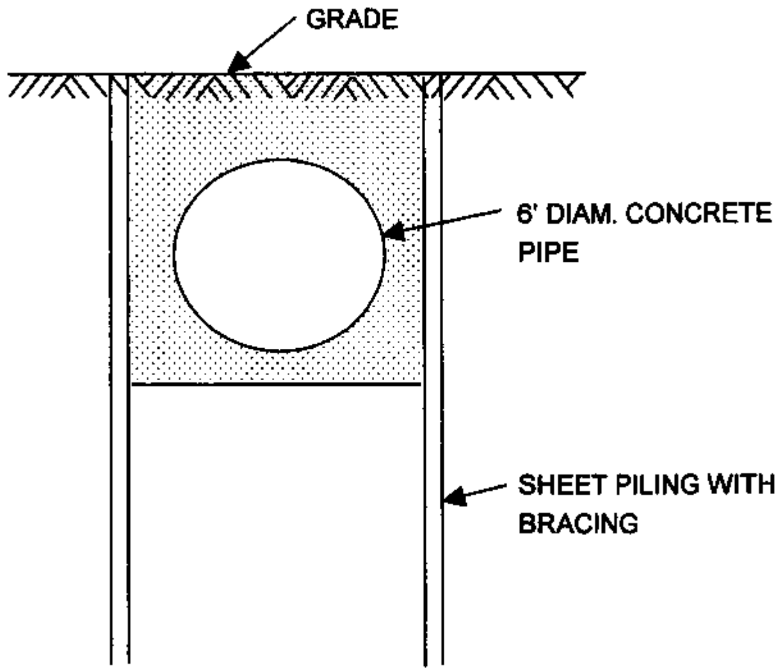
JUSTIFICATION:

This proposal is recommended based on the advantages cited above and the reduced cost.

DISCUSSION

The principal concern with HDPE pipe is that it will float when empty if enough head is developed by flooding. Concrete pipe will also float under these conditions, but has more mass and will require less anchorage to resist floatation. HDPE has been successfully used in most of the same applications as concrete pipe and avoids hydrogen sulfide corrosion which is prevalent in gravity concrete pipelines.

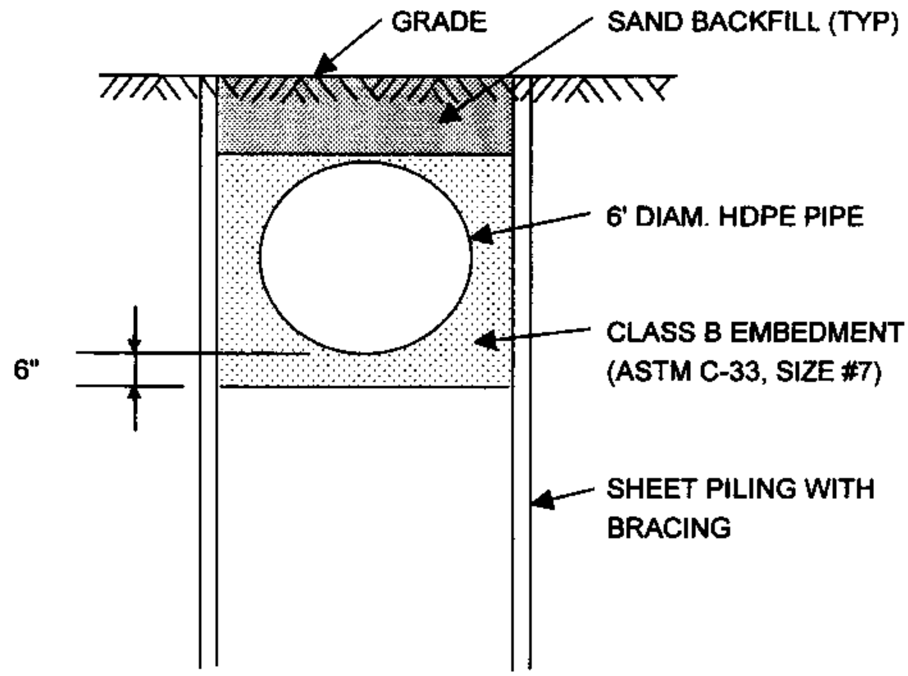
ORIGINAL CONCEPT — SKETCH



TYPICAL SECTION

NTS

PROPOSED CONCEPT — SKETCH



TYPICAL SECTION

NTS

PROPOSAL NO.: RPS-39

PROPOSAL PAGE NO.: 6

COST SAVINGS ESTIMATE

		Original Concept		Proposed Concept	
Item/Units	Unit Cost	Quantity	Total	Quantity	Total
Concrete Pipe	$235.00	2,070	$486,450		
HDPE Pipe, 6 ft.	$196.00		$0	2,070	$405,720
Anchorage Requirements * (CY)	$200.00	600	$120,000	900	$180,000
* Based on vol of concrete required					
to anchor pipe against flotation. Includes					
anchorage accessories.					
Subtotal			$606,450		$585,720
Contingencies - 20%			$121,290		$117,144
Subtotal			$727,740		$702,864
10% E&D			$72,774		$70,286
10% S&A			$72,774		$70,286
TOTALS			$873,288		$843,437
NET SAVINGS					$29,851

All costs from project MCACES Report and MCACES Database except if noted below:

1. Cost were obtained from KWH Pipe as noted herein.
2.
3.

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO.: RPS-41; HPS-10

PROPOSAL PAGE NO.: 1

DESCRIPTION: Lower RPS and HPS to Ground Level

CRITERIA CHALLENGE: No **CRITERIA NO.:**

ORIGINAL CONCEPT: The pump houses at RPS and HPS are situated above grade.

PROPOSED CONCEPT: Lower both pump houses few feet to lower their visibility and improve on the aesthetics.

SUMMARY OF COST SAVINGS

	FIRST COST	PRESENT WORTH OF O&M COSTS	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$23,000	$0	$23,000
PROPOSED CONCEPT	$0	$0	$0
SAVINGS	$23,000	$0	$23,000

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Draws less wind forces.
- Aesthetically pleasing and blends better with residential surroundings.
- Expedites construction.

DISADVANTAGES:

- Motors would be damaged in catastrophic flood.

JUSTIFICATION:

Improves the aesthetics of the pump houses with the surroundings and results in a small reduction in cost.

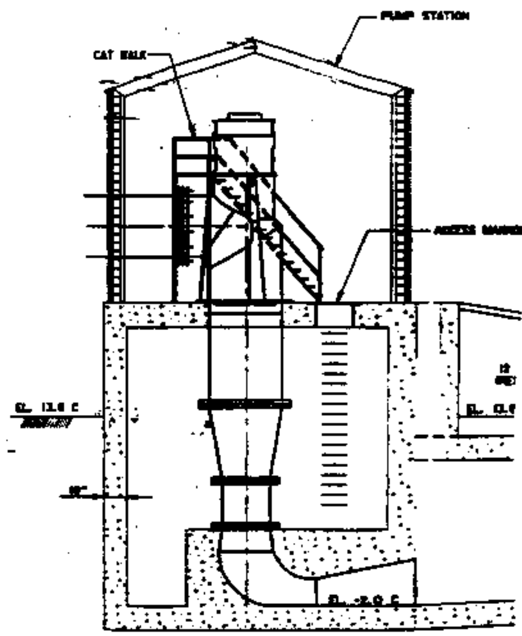
DISCUSSION

These stations would not be important in draining the City after a catastrophic flood event since the major stations should be operable and able to handle the flows.

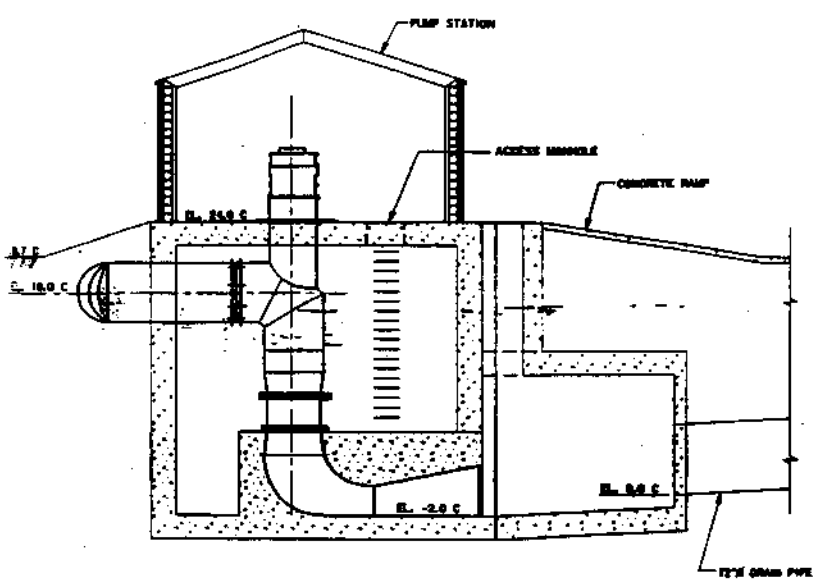
PROPOSAL NO.: RPS-41; HPS-10

PROPOSAL PAGE NO.: 4

ORIGINAL CONCEPT — SKETCH



HPS



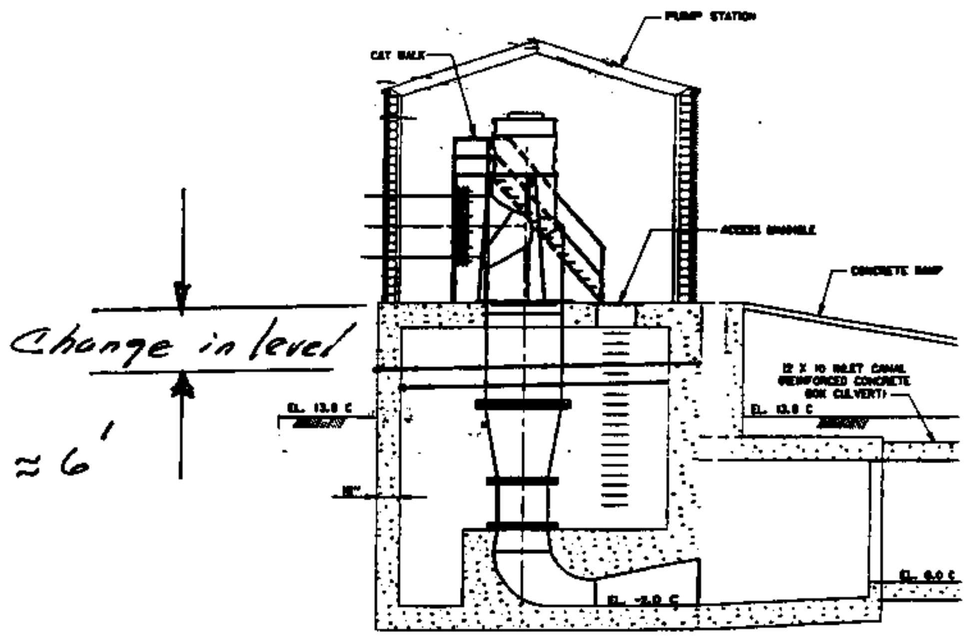
RPS

VALUE ENGINEERING STUDY

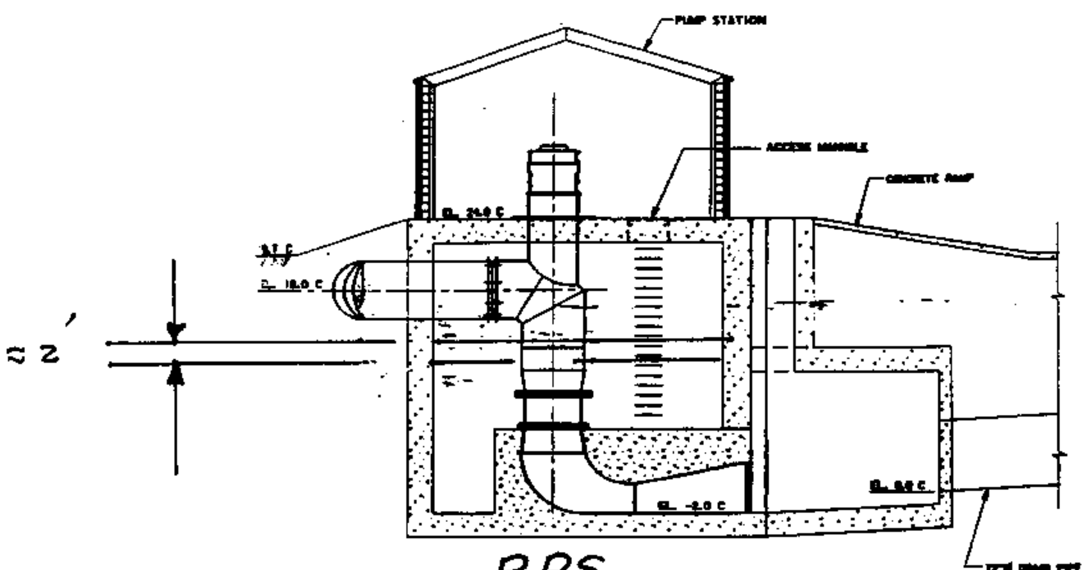
PROPOSAL NO.: RPS-41; HPS-10

PROPOSAL PAGE NO.: 5

PROPOSED CONCEPT — SKETCH



HPS



RPS

ORIGINAL CONCEPT — CALCULATIONS

The calculations on this page represent the quantities of material from the Original Concept that will not be needed by adopting the Proposed Concept.

House Size ⇒ 25' x 30' x 30' (deep)

Concrete thickness = 12"

Area = (25 x 1 x 2) + (30 x 1 x 2) = 110 ft^2

At HPS ⇒ Total Volume = 110 x 6 = 660 ft^3

= 24.4 yd^3

At RPS ⇒ Total Volume =110 x 2 = 220 ft^3

= 8.14 yd^3

Backfill ⇒ 50 x 50 x 1 = 2,500 ft^2

At HPS ⇒ 2,500 x 6 = 15,000 ft^2

= 556 yd^3

At RPS ⇒ 2,500 x 2 = 5,000 ft^3

= 185 yd^3

$3/yd general fill

$10/yd for top soil

PROPOSAL NO.: RPS-41; HPS-10

PROPOSAL PAGE NO.: 7

COST SAVINGS ESTIMATE

		Original Concept		Proposed Concept	
Item/Units	Unit Cost	Quantity	Total	Quantity	Total
Concrete at HPS, yd^3	$270	24.4	$6,588		
Concrete at RPS, yd^3	$270	8.14	$2,198		
Backfilling at HPS, yd^3	$10	556	$5,560		
Backfilling at RPS, yd^3	$10	185	$1,850		
Subtotal			$16,196		
Contingencies - 20%			$3,239		
Subtotal			$19,435		
10% E&D			$1,943		
10% S&A			$1,943		$0
TOTALS			$23,321		$0
					$23,321

All costs from project MCACES Report and MCACES Database except if noted below:

1.

2.

3.

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO: HPS-2A

PROPOSAL PAGE NO: 1

DESCRIPTION: Locate Vertical (Submersible) Pump Station near Intersection of Harrison and Fleur de Lis Streets with a force main to the 17th Street Canal

CRITERIA CHALLENGE: No **CRITERIA NO:**

ORIGINAL CONCEPT: Use two 200 cfs vertical pumps at the Harrison Pump Station (HPS) located at the 17th Street Canal with a gravity flow, 12 foot wide by 10-foot high cast in place concrete box culvert from the intersection of Harrison and Fleur de Lis Streets to the pump station.

PROPOSED CONCEPT: Relocate the HPS to the open lot at the Harrison and Fleur de Lis street intersection, and use two 200 cfs vertical (submersible) pumps to pump drainage through a force main to the 17th Street Canal. The cost difference is essentially the difference between a gravity line and a force main between the two locations.

SUMMARY OF COST SAVINGS

	FIRST COST	PRESENT WORTH OF O&M COSTS	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$1,876,000	$0	$1,876,000
PROPOSED CONCEPT	$1,118,000	$0	$1,118,000
SAVINGS	$758,000	$0	$758,000

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Real estate will cost less because the HPS can be located at the Harrison and Fleur de Lis Street intersection where a vacant lot available for a pump station site.
- Lower quantities and cost of the force main pipeline installation with regard to excavation, backfill, and pipe because the force main from the Fleur de Lis and Harrison Street intersection will be smaller in size and shallower in depth than the proposed 12 foot wide by 10 foot high, CIP concrete box culvert.

DISADVANTAGES:

- Location of pump station is closer to neighborhood, which will present noise and visual impact on area.

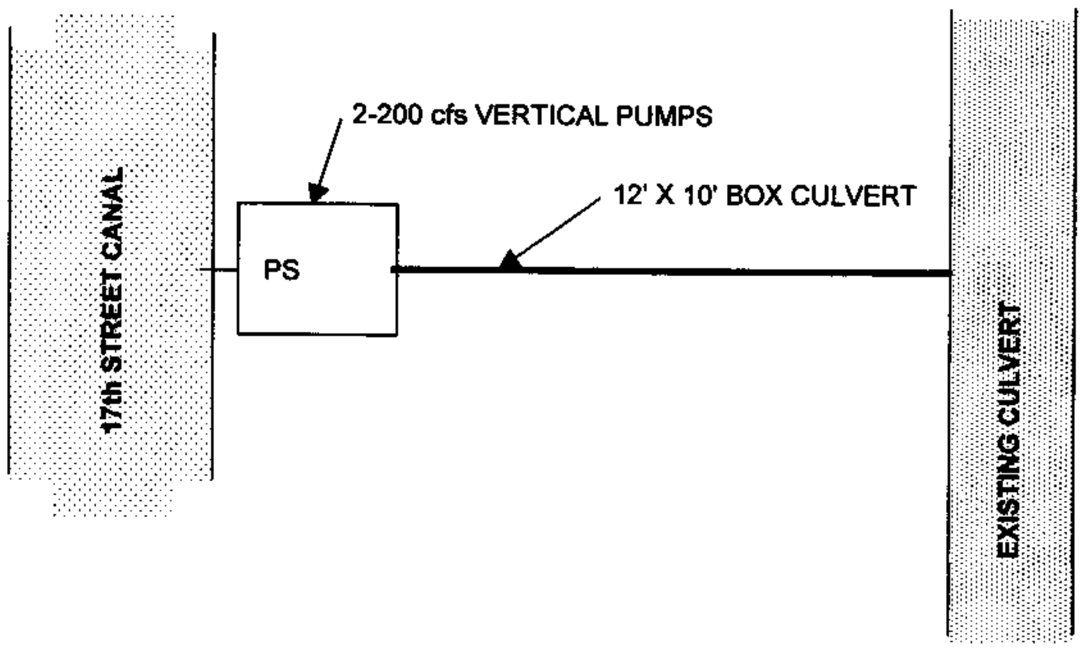
JUSTIFICATION: This alternative is recommended because of its high potential for cost savings and the advantages listed.

DISCUSSION

This alternative is developed similar to Alternative RPS-5A with regard to the pipeline costs.

The force main is designed for 8 fps velocity. The use of submersible pumps with, or without, hydraulic drives could be considered and would represent an increase in cost. (See Appendices F and G for information related to submersible pumps and hydraulic drives.)

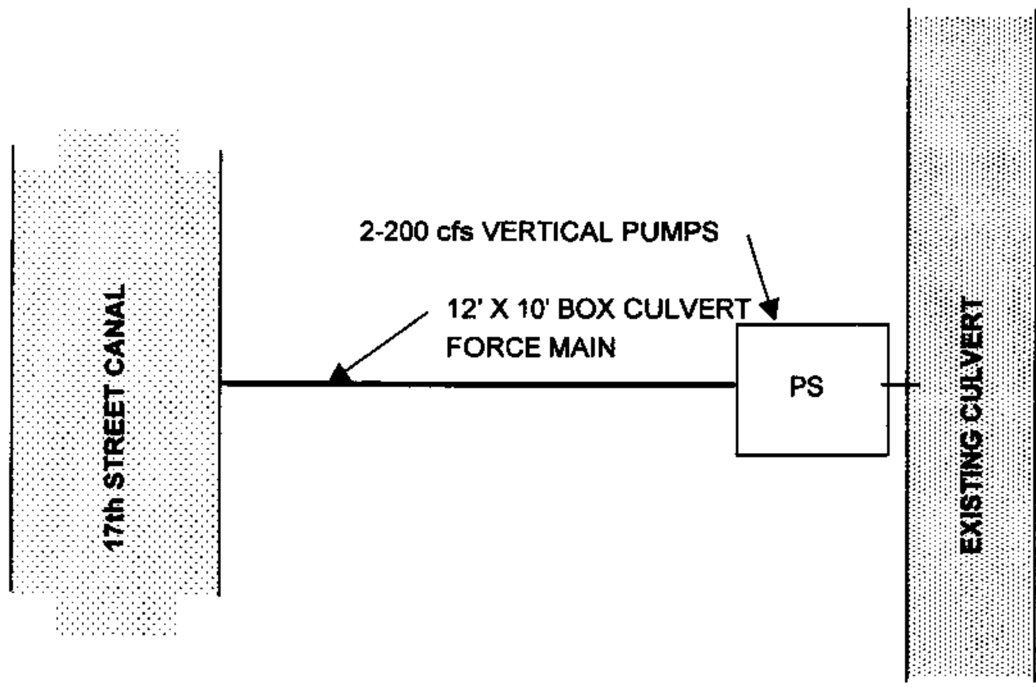
ORIGINAL CONCEPT — SKETCH



PROPOSAL NO: HPS-2A

PROPOSAL PAGE NO: 5

PROPOSED CONCEPT — SKETCH



PROPOSED CONCEPT — CALCULATIONS

Proposed pipeline size for 8 fps velocity for 400 cfs flow = 8.0 ft diameter

From RPS-5A cost of 9' diameter pipe = $1,853,630/1,320 LF = $1,400/LF

Cost of 8' diameter pipe is approximately 92.5% of the 9' diameter pipe =

$1,400/LF x 0.925 = $1,295/LF, use $1,300

Length of pipeline = 600 ft

Cost of 8 ft diameter pipeline = 1,300 x 600 = $780,000

VALUE ENGINEERING STUDY

PROPOSAL NO: HPS-2A

PROPOSAL PAGE NO: 7

COST SAVINGS ESTIMATE

		Original Concept		Proposed Concept	
Item/Units	Unit Cost	Quantity	Total	Quantity	Total
Original 12'x10' CIP CBC	$1,303,076	1	$1,303,076	0	$0
Proposed Pipeline (8' Dia.)	$780,000	0	$0	1	$780,000
Real Estate per SF	$40.00		$0	2500	$100,000
Subtotal			$1,303,076		$880,000
Contingencies - 20%			$260,615		$176,000
Subtotal			$1,563,691		$1,056,000
10% E&D			$156,369		$105,600
10% S&A			$156,369		$105,600
TOTALS			$1,876,429		$1,267,200
NET SAVINGS					609,229

All costs from project MCACES Report and MCACES Database except if noted below:

1.

2.

3.

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls
PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO: HPS-2B

PROPOSAL PAGE NO: 1

DESCRIPTION: Locate Submersible, or Vertical, Pump Station near Intersection of Harrison and Fleur de Lis Streets with a force main to the 17th Street Canal

CRITERIA CHALLENGE: No **CRITERIA NO:**

ORIGINAL CONCEPT: Use 2-125 cfs vertical pumps at the Harrison Pump Station (HPS) located at the 17th Street Canal with a gravity flow, 9-foot diameter pipeline from the intersection of Harrison and Fleur de Lis Streets to the pump station.

PROPOSED CONCEPT: Use 2-125 cfs submersible, or vertical, pumps at the HPS located near the intersection of Harrison and Fleur de Lis Streets with a force main to the 17th Street Canal.

SUMMARY OF COST SAVINGS

	FIRST COST	PRESENT WORTH OF O&M COSTS	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$3,225,000	$0	$3,225,000
PROPOSED CONCEPT	$2,983,000	$0	$2,983,000
SAVINGS	$242,000	$0	$242,000

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Will have the same advantages as HPS-4.1 with regard to using submersible pumps in lieu of vertical pumps.
- Lower quantities and cost of the force main pipeline installation with regard to excavation, backfill, and pipe because the force main from the Fleur de Lis and Harrison Street intersection will be smaller in size and shallower in depth than the proposed 9-foot diameter pipeline.

DISADVANTAGES:

- Will have the same disadvantages as HPS-4.1 with regard to using submersible pumps in lieu of vertical pumps.
- Location of pump station is closer in neighborhood.

JUSTIFICATION: This alternative is recommended for implementation due to its high potential for cost savings.

DISCUSSION

This alternative is developed similar to Alternative RPS-5A with regard to the pipeline and pump station structure costs.

The cost differential for the vertical pumps versus submersible pumps was also based on alternative RPS-5A. . (See Appendices F and G for information related to submersible pumps and hydraulic drives.)

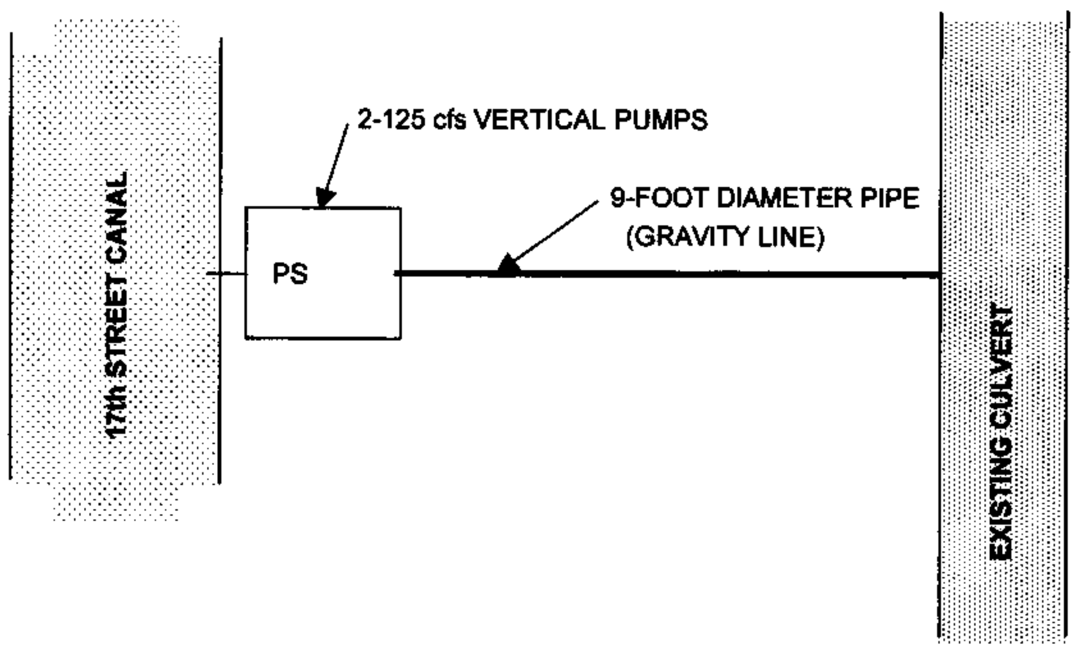
The force main is designed for 8 fps velocity.

The location of the submersible pump station could be in the street Right-of-Way and avoid the purchase of real estate.

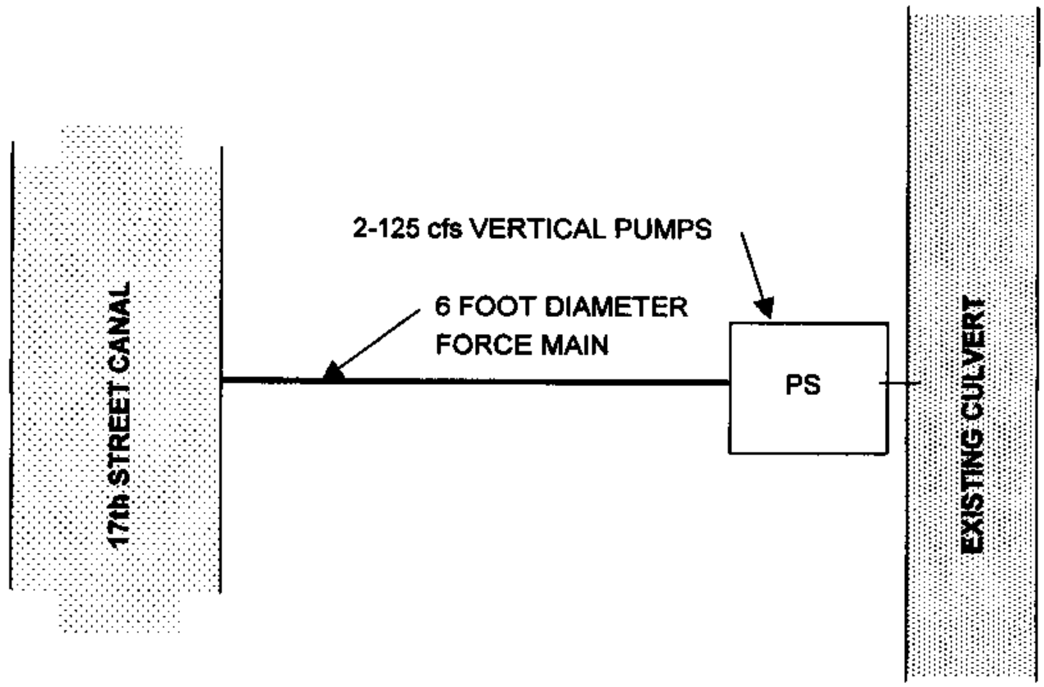
PROPOSAL NO: HPS-2B

PROPOSAL PAGE NO: 4

ORIGINAL CONCEPT — SKETCH



PROPOSED CONCEPT — SKETCH



ORIGINAL CONCEPT — CALCULATIONS

Cost of RPS-5A 9-foot diameter pipeline = \$1,853,630/1320/LF = \$1,400/LF

HPS-2B 9-foot diameter pipeline length = 600 LF

Cost of HPS-2B 9-foot diameter pipeline = 1,400 x 600 = \$840,000

Cost of pump station with 2-125 cfs vertical pumps is equal to \$1,399,693 (See RPS-5A)

Cost of pump station w/o vertical pumps and superstructure is equal to \$646,693 (See RPS-5A)

PROPOSED CONCEPT — CALCULATIONS

Proposed pipeline size for 8 fps velocity for 250 cfs flow is the same as RPS-5A = 6.0 ft dia.

From RPS-5A cost of 6' diameter pipe = $1,553,630/1320 LF = $1,175/LF (Installed)

Length of pipeline = 600 ft

Cost of 6 ft diameter pipeline = 1,175 x 600 = $705,000

Cost of 125 cfs submersible pumps = $360,000 (See Alternative RPS-5A)

PROPOSAL NO: HPS-2B

PROPOSAL PAGE NO: 8

COST SAVINGS ESTIMATE

		Original Concept		Proposed Concept	
Item/Units	Unit Cost	Quantity	Total	Quantity	Total
Original 9' Diameter Pipeline	$840,000	1	$840,000	0	$0
Original PS Cost (2-125cfs Vert. Pumps)	$1,399,693	1	$1,399,693	0	$0
Proposed Pipeline (6' Dia.)	$705,000	0	$0	1	$705,000
Proposed PS (w/o Pumps and Super.)	$646,693	0	$0	1	$646,693
Proposed 125 cfs Submersible Pumps	$360,000	0	$0	2	$720,000
Subtotal			$2,239,693		$2,071,693
Contingencies - 20%			$447,939		$414,339
Subtotal			$2,687,632		$2,486,032
10% E&D			$268,763		$248,603
10% S&A			$268,763		$248,603
TOTALS			$3,225,158		$2,983,238
NET SAVINGS					241,920

All costs from project MCACES Report and MCACES Database except if noted below:

1.

2.

3.

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO.: HPS-3

PROPOSAL PAGE NO.: 1

DESCRIPTION: Replace box culvert near Harrison Pumping Station (HPS)with pipe

CRITERIA CHALLENGE: No **CRITERIA NO.:**

ORIGINAL CONCEPT: Install approximately 550 feet of 10 ft x 12 ft box culvert from Fleur De Lis/Harrison intersection to the proposed HPS.

PROPOSED CONCEPT: Install 550 feet of two 9-foot diameter parallel pipes from Fleur De Lis/Harrison intersection to the proposed HPS. The pipe material being considered for this alternative is HDPE.

SUMMARY OF COST SAVINGS

	FIRST COST	INTEREST LOST DURING CONST.	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$594,000	$70,000	$664,000
PROPOSED CONCEPT	$509,000	$0	$509,000
SAVINGS	$85,000	$70,000	$155,000

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Long service even in corrosive environments.
- Leak-free joints
- Excellent hydraulic characteristics
- Lightweight/long length with fewer joints to assemble
- Rugged handling performance
- Reduces construction time, which will minimize impact to the adjacent community.
- Delivers project benefits faster.
- Lighter weight pipe will result in less overall settlement.

DISADVANTAGES:

- Will need to anchor pipe vertically to resist uplift
- Wider trench excavation.
- Timely shipping scheduling required to minimize lay-down area.

JUSTIFICATION:

This proposal is recommended based on the advantages cited above and the reduced cost.

DISCUSSION

This alternative was developed considering two 9-foot diameter HDPE parallel pipelines in a common trench. Sufficient compaction of backfill is necessary for this alternative to be feasible. Although the lighter weight pipe will require additional anchorage, it will also settle less than a concrete box culvert.

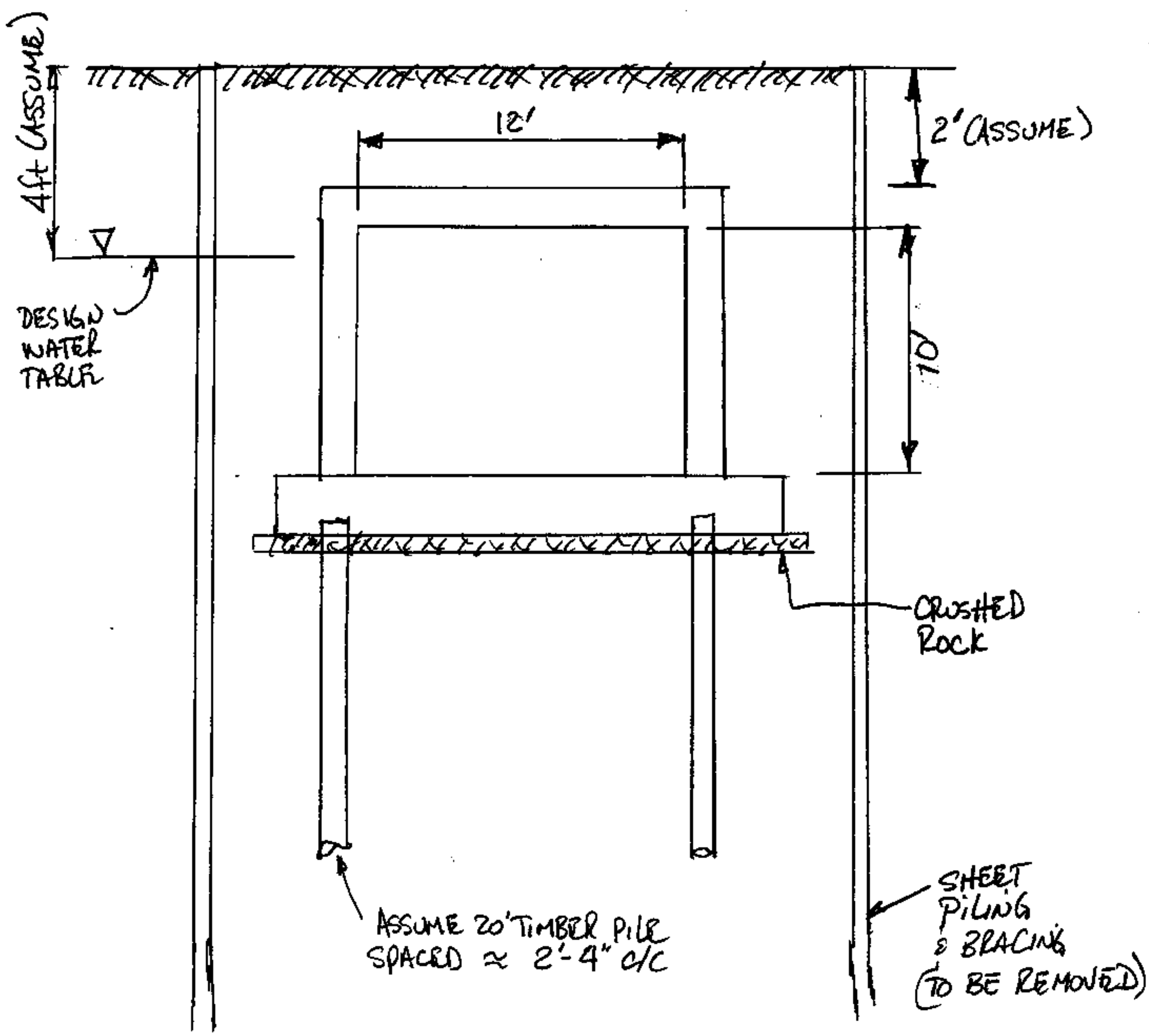
Due to less concrete volume and faster pipe laying times, it was assumed that the Proposed Concept could be complete one year earlier than the Original Concept. The benefit from this was determined as the interest lost for an additional year of construction.

VALUE ENGINEERING STUDY

PROPOSAL NO.: HPS-3

PROPOSAL PAGE NO.: 4

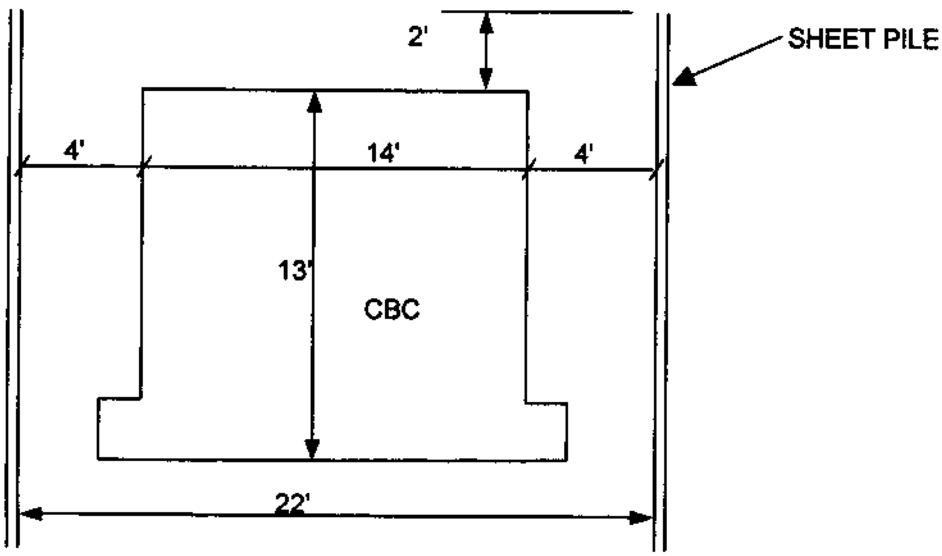
ORIGINAL CONCEPT — SKETCH



12' x 10' CAST-IN-PLACE BOX CULVERT

SCALE: NTS

ORIGINAL CONCEPT — SKETCH



EXCAVATION

(22 x 15 x 550) / 27 = 6722.222 CY

USE 7,000 CY

BACKFILL

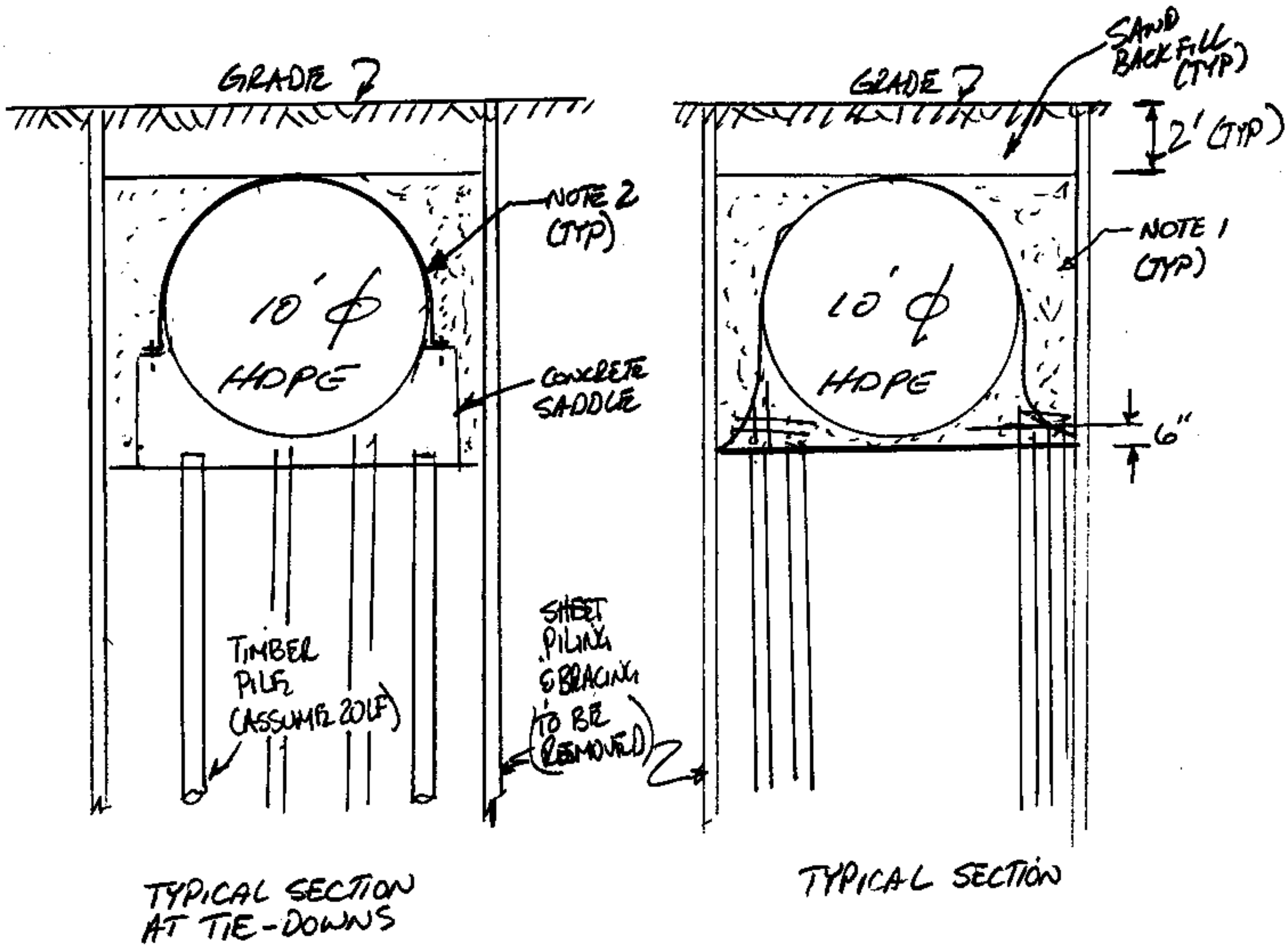
7,000 - ((14 x 13 x 550) / 27) = 3292.593

USE 3,300 CY

PROPOSAL NO.: HPS-3

PROPOSAL PAGE NO.: 6

PROPOSED CONCEPT — SKETCH

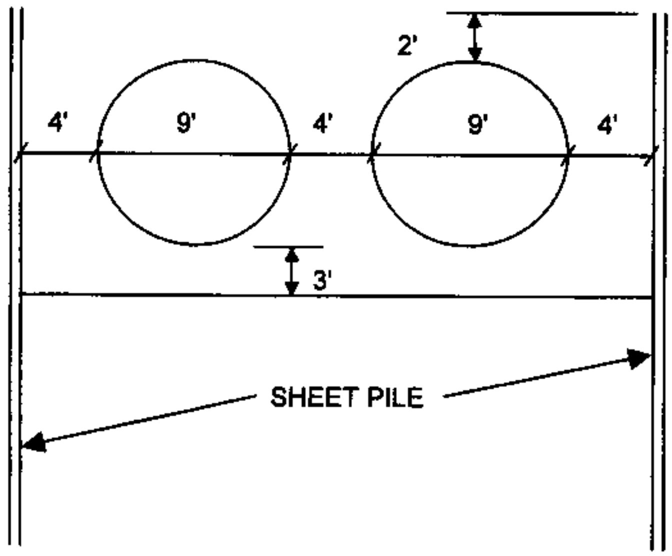


NOTE:

1) CLASS B EMBEDMENT (ASTM 33 SIZE #7)

2) 10ft DIAMETER HDPE PIPE

PROPOSED CONCEPT — SKETCH



EXCAVATION

(30 x 14 x 550) / 27 = 8555.556 CY

USE 8,500 CY

BACKFILL

8,500 -((PIPE AREA x 2 x 550)/27) = 5908.889 CY

USE 5,900 CY

ORIGINAL CONCEPT — CALCULATIONS

Uplift Force on culvert $\simeq$ 12' x 14' x 62.4 PCF = 10.5 K/ft

Weight of 2-ft. soil above culvert = 2' x 110PCF x 14' = 3.0 K/ft.

Weight of box culvert = {[(11 + 11 + 12) x 1'] + (1.5' x 14')} x 150 PCF = 8.3 K/ft

Net uplift = 10.5 – (3.0 + 8.3) = -0.8K/ft (No uplift concern for box culvert)

ORIGINAL CONCEPT - INTEREST LOST DURING CONSTRUCTION (1 YEAR)
(single value calculation)

	Spent	Total	Remaining	Interest	TOTALS
First Cost (See attached revision)					$1,600,000
Interest lost during 2-yr construction					
End of Year 1	-$533,333	$1,600,000	$1,066,667	$69,333	
					$69,333

PROPOSED CONCEPT — CALCULATIONS

- Cost of Concrete/ft = Σ Concrete from cost estimate
  = \$412,713
  Cost/ft. = 412,713/550 = \$750.39

- Cost of HDPE $\Rightarrow$ \$567/8-ft. section
  Cost/ft $\Rightarrow \frac{567}{8}$ = \$71/ft.

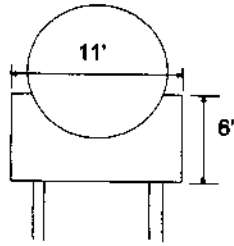
- Buoyancy:
  Water elevation assumed to be at grade.
  Uplift force on pipe = 2ea x 9' x 12' x 62.4 PCF = 13.5 K/ft

  Weight of 2-ft. soil above pipe = 2 ea x 2' x 110PCF x 9' = 4.0 K/ft.

  Net uplift = 9.5 K/ft
  Assume 8' pipe sections, therefore total uplift for 550' of pipe is equal to
  550 x 9.5 K/ft = 5,225 K
  Assume each pile provides 0.25 K/SF resistance, therefore total length of 10" diam piles needed to resist uplift = 5,225 / (Pile Area/LF x 0.25) = 5,225 / .65 = 8,040 LF Since13,280 lineal feet of piling is being installed for the box culvert, no additional piling is needed to resist uplift on the pipe. Assume 8,000 LF of piling to resist uplift and that piles are 25' in length. Therefore 8,000/25 = 320 piles to resist uplift. Assume piles are paired to resist uplift; therefore there are 4 piles at each anchorage point (2 per each pipe) or a total of 160 anchorage points for both pipelines.

- Additional cost to anchor piles that support pipe and resist uplift:

  Concrete Vol. = 2' x 6' x 11' – Sector Area x 2'
  = 132 – (20 x 2) = 92CF, 92/27 = 3.4 CY, Use 4 CY
  4CY x 160 x \$250/CY = \$160,000
  106 x \$200/ancor strap (etc.) = <u>\$32,000</u>
  Total cost for pipe anchorage = \$192,000, Use \$200,000



TYPICAL (2 EA)

PROPOSAL NO.: HPS-3

PROPOSAL PAGE NO.: 10

COST SAVINGS ESTIMATE

Item/Units	Unit Cost	Original Concept Quantity	Original Concept Total	Proposed Concept Quantity	Proposed Concept Total
Cost of Concrete/ft.	$750.40	550	$412,720	0	$0
Cost of HDPE, LF	$71.00	0	$0	550	$39,050
Anchorage Costs, LS	$200,000		$0	1	$200,000
Excavations, CY	$6.50	7000	$45,500	8500	$55,250
Backfill, CY	$10.00	3300	$33,000	5900	$59,000
Subtotal			$412,720		$353,300
Contingencies - 20%			$82,544		$70,660
Subtotal			$495,264		$423,960
10% E&D			$49,526		$42,396
10% S&A			$49,526		$42,396
TOTALS			$594,317		$508,752
NET SAVINGS					$85,565

All costs from project MCACES Report and MCACES Database except if noted below:

1.

2.

3.

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

PROPOSAL NO.: HPS-9

PROPOSAL PAGE NO.: 1

DESCRIPTION: Use Single Pump

CRITERIA CHALLENGE: No **CRITERIA NO.:**

ORIGINAL CONCEPT: Uses two pumps at 125 cfs each to pump out additional collected water.

PROPOSED CONCEPT: Combine flow requirements into a single 250 cfs pump.

SUMMARY OF COST SAVINGS

	FIRST COST	PRESENT WORTH OF O&M COSTS	LIFE CYCLE COSTS
ORIGINAL CONCEPT	$2,800,000	$496,000	$3,296,000
PROPOSED CONCEPT	$2,212,000	$385,000	$2,597,000
SAVINGS	$588,000	$111,000	$699,000

PROPOSAL NO.: HPS-9

PROPOSAL PAGE NO.: 2

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Fewer pumps to maintain; reduces O&M costs.
- Expedites construction.
- Smaller station structure.
- Simpler system.
- Less spare parts and inventory.

DISADVANTAGES:

- No back-up in case of failure (contingency).
- May require higher flow to kick-in.
- More draw down on electrical system.

JUSTIFICATION:

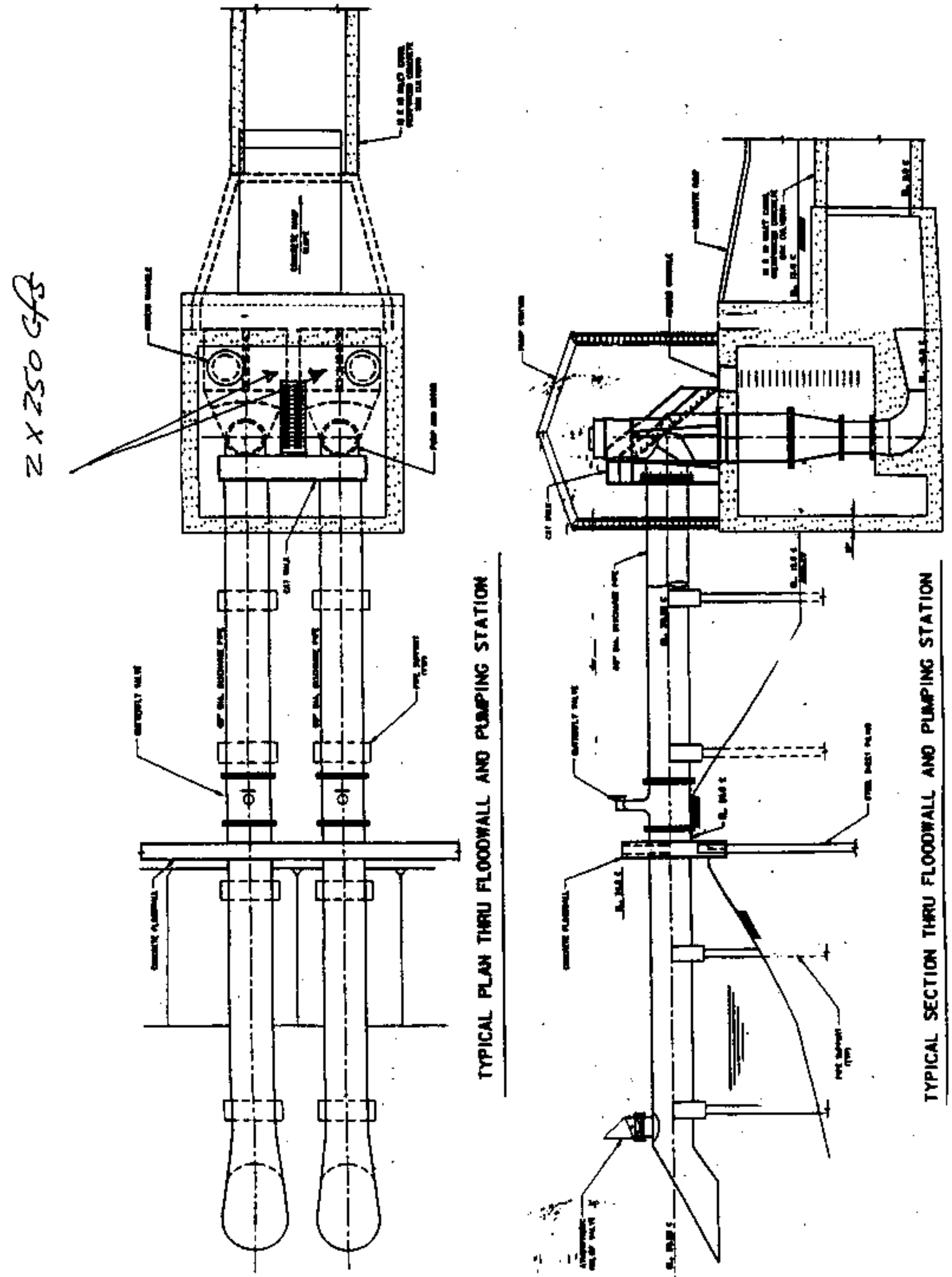
This proposal is recommended based on the advantages listed above and the cost savings.

DISCUSSION

A major concern of this proposal is the apparent reliance on a single pumping unit to satisfy the required function. However, since this station is supplemental to a larger system, unit redundancy is ***not*** critical. Additionally, statistical analysis of rotating machinery substantiates that fewer units reduces the number of outages and increases the on-line availability and the reliability of the system.

The Life Cycle Cost calculations did not consider energy costs since equal volumes of water would be moved, nearly equal amounts of energy would be required to move the water. O&M costs are based on 1% of the cost of the first cost items listed.

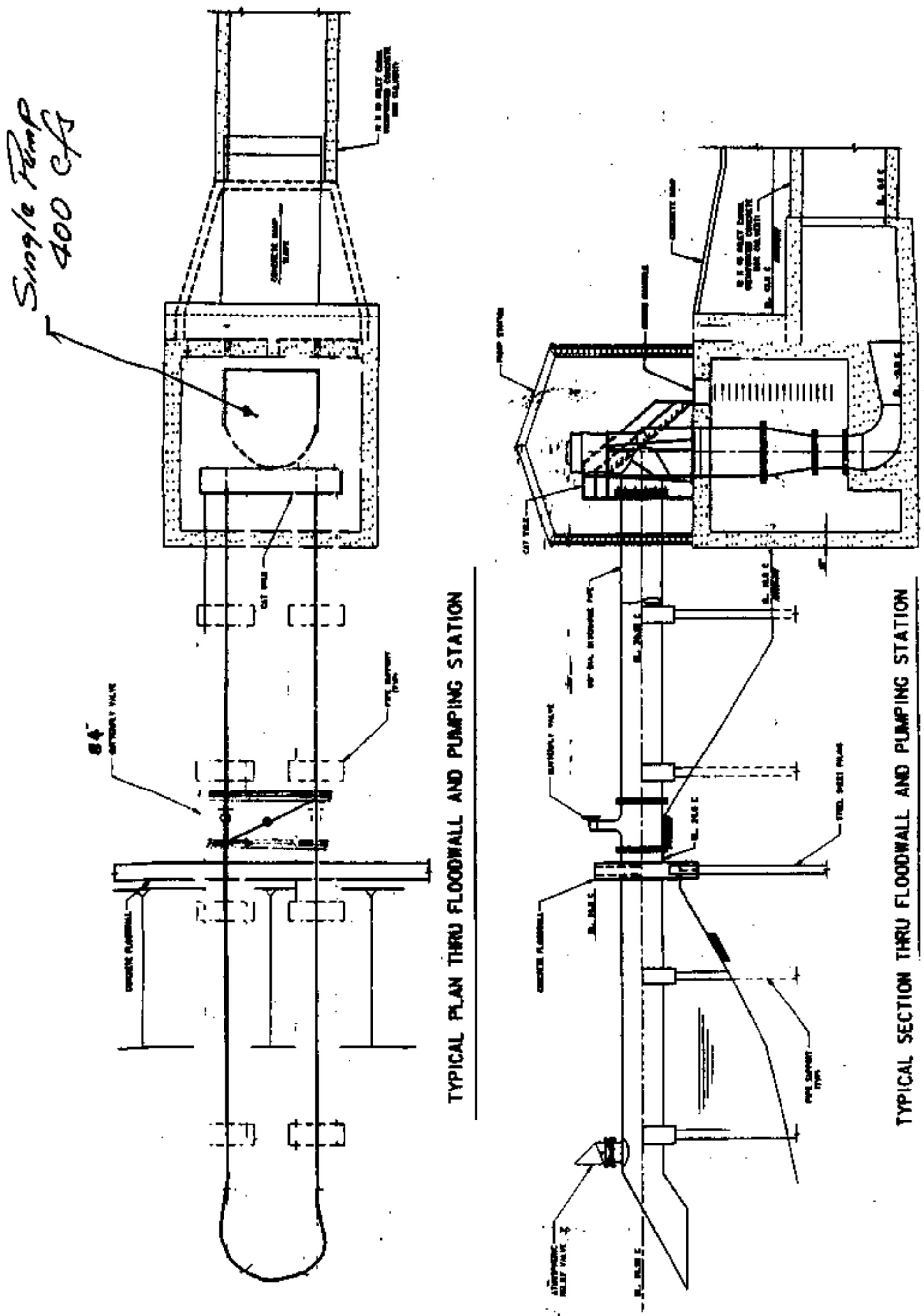
ORIGINAL CONCEPT — SKETCH



PROPOSAL NO.: HPS-9

PROPOSAL PAGE NO.: 5

PROPOSED CONCEPT — SKETCH



ORIGINAL CONCEPT — CALCULATIONS

1. Pump Costs ⇒ 2 x 475,000 = $950,000
2. Valves (60"), ea. ⇒ 2 x 30,000 = $60,000
3. Pipe (60"), 160LF x 235/Lf = $37,600
4. Others, LS ⇒ $896,820 (no contingencies)

PROPOSAL NO.: HPS-9

PROPOSAL PAGE NO.: 7

PROPOSED CONCEPT — CALCULATIONS

1. Pump at 400 cfs = $ 700,000
2. Valve (84") = $50,000 (Price quote from Pratt/Keystone for steel flanged valve)
3. Pipe (84"), 80LF x 300/Lf = $24,000

   Subtotal = $774,000

4. Others ⇒ = 0.85 ($896,820)= $762,297

PROPOSAL NO.: HPS-9

PROPOSAL PAGE NO.: 8

COST SAVINGS ESTIMATE

Item/Units	Unit Cost	Original Concept Quantity	Original Concept Total	Proposed Concept Quantity	Proposed Concept Total
2 x 250 Pumps, ea.	$475,000	2	$950,000	0	$0
1 x 400 Pump, ea.	$700,000	0	$0	1	$700,000
Valves, ea. (60")	$30,000	2	$60,000	0	$0
Valve, ea. (84")	$50,000		$0	1	$50,000
Others, LS			$896,820		$762,297
Discharge Pipe (60")	$235	160	$37,600		
Discharge Pipe (84")	$300.00		$0	80	$24,000
Subtotal			$1,944,420		$1,536,297
Contingencies - 20%			$388,884		$307,259
Subtotal			$2,333,304		$1,843,556
10% E&D			$233,330		$184,356
10% S&A			$233,330		$184,356
TOTALS			$2,799,965		$2,212,268
NET SAVINGS					$587,697

All costs from project MCACES Report and MCACES Database except if noted below:

1.

2.

3.

LIFE CYCLE COST ANALYSIS

LIFE CYCLE PERIOD 50 DISCOUNT RATE 6.500%

INITIAL COST ITEMS					USEFUL LIFE (YEARS)	ORIGINAL CONCEPT PRESENT WORTH	PROPOSED CONCEPT PRESENT WORTH
Pumps & Valves					25	$1,010,000	$750,000
Pipe					50	$37,600	$50,544
Mob/Demob					50	$896,820	$762,297
					SUB-TOTAL	$1,944,420	$1,562,841
REPLACEMENT ITEMS OR FUTURE ITEMS FOR OC or PC, OR SALVAGED ITEMS (SV)	YEARS	PRESENT WORTH FACTOR	COST or SALVAGE VALUE (-)	OC or PC		PRESENT WORTH	PRESENT WORTH
Pumps & Valves	25	0.20714	$1,010,000	OC		$209,209	
Pump & Valve	25	0.20714	$750,000	PC			$155,354
					SUB-TOTAL	$209,209	$155,354
ANNUAL EXPENDITURES	YEARS	PRESENT WORTH FACTOR	ANNUAL COST	OC or PC		PRESENT WORTH	PRESENT WORTH
O&M	50	14.72452	$19,444	OC		$286,307	
O&M	50	14.72452	$15,628	PC			$230,121
					SUB-TOTAL	$286,307	$230,121
					TOTAL PRESENT WORTH	$2,439,936	$1,948,315
					LIFE CYCLE SAVINGS		$491,621

DESIGN SUGGESTIONS

DESIGN SUGGESTIONS

G-9 CONSIDER EARLY COMPLETION INCENTIVES

Early completion incentives encourage the contractor to deploy additional resources (equipment and labor) to achieve early completion.

The procedure requires review of the proposed contractor schedule and manpower histograms. Altering the sequence of "some" activities and increasing resources (labor and equipment) can shorten the construction schedule.

G-30 MAKE ALL PUMPS FOR BOTH P.S. SAME SIZE

This comment is based on the premise that:

1. Standardizing equipment is a preferable quality practice.
2. Ease of design.
3. Ease of construction details for supports and associated fittings.
4. Easier for maintenance and training of personnel.
5. Better for stockpiling spare parts.

G-41 CONSIDER POWER SUPPLY RELIABILITY

The current design proposes electrical drive for the two new pump stations without redundant power supply. While these stations are supplemental to the larger primary pumping system (P.S. #7 and #12), there needed service will have a strong correlation to possible interruption in commercial service. These stations will be needed in very heavy rainfall events that could very well be accompanied by heavy electrical and wind events. This correlation and failure probability should be considered in the evaluation of overall project cost-effectiveness. Alternative power supplies should also be considered. For vertical and hydraulic drive pumps, diesel or natural gas could be utilized. The latter would offer a very high degree of reliability without the need to handle and store fuel. Soundproofing drive unit structures would also be necessary, given their locations.

RPS-6 DON'T EVEN THINK ABOUT GOING DOWN ALLEY

Current proposed layout calls for the installation of 72-inch diameter pipe, connecting to REL-PS, through a populated "alley" just parallel to Argonne. The road-alley is narrow. It would create substantial construction difficulties.

It is better if the 72-inch P/L can be shifted to another adjacent road such as Gen. Haig for example

RPS-7 ROUTE SUCTION LINE DOWN NEAREST STREET IN NEED OF REPAIR

Installation of the 72-inch diameter suction line through heavily populated area with narrow road will cause serious disruption to quality of life, accessibility, and convenience to the residents. It is better to route the line through less populated area with a wider less trafficked road, especially one in need of repair.

RPS-9 JACK AND BORE SUCTION LINE

Construction of the 72-inch diameter suction line REL-PS, by conventional methods may cause major disruption to the lifestyle of the people living along proposed route.

Jacking the line can mitigate the disruption, and contributes towards more satisfied citizens.

Issues of cost will have to be addressed.

RPS-10 CONSIDER PRE-FAB STEEL FORMED SUCTION FOR PROPOSED PUMP STATIONS

The current plans indicate concrete cast-in-place formed suction intakes for both the proposed Robert E. Lee and Harrison Ave. Pump Stations. Similar applications have utilized pre-fab steel formed intakes that would appear to offer substantial construction advantages. The in-situ forming of the intricate concrete structure required to accomplish the proper suction shape will be difficult and time consuming. A steel suction form would be easier to fabricate at an off-site location, more uniform in shape, and would reduce the construction time. Shop fitting of the pump to the suction form would also appear to reduce potential misalignment problems. A minor disadvantage would be long-term corrosion of the suction apparatus. Replacement could be scheduled to occur concurrent with actual pump replacement that is estimated to occur every 25 years. Since the steel suction form would be encased in concrete, it may not require replacement if the concrete has taken the shape of the suction form and is not deteriorating. Some minor repair of the concrete may be required. Cost savings would be apparent in the range of $50,000 to $100,000 per station. See the attached sketch at the end of the suggestions.

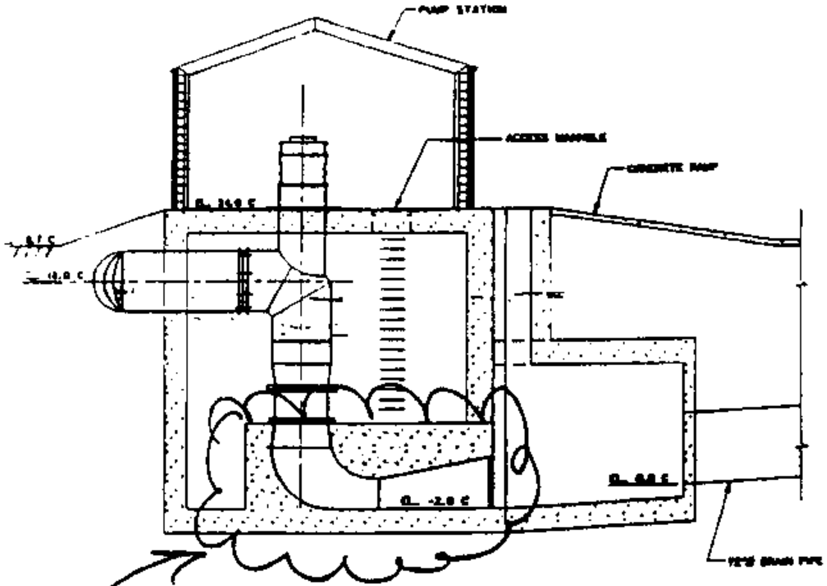
RPS-18 USE NATURAL GAS DRIVES WITH ELECTRICAL BACK-UP

Natural gas is a readily available cheap energy source in Louisiana. Electrical back-up may be used.

RPS-20 ADD CCTV VIDEO MONITORING TO PS'S

CCTV has the following advantages:

1. Monitoring operations.
2. Security.
3. Emergency Response.



TYPICAL SECTION THRU PUMPING STATION

CHANGE FROM FORMED CONCRETE
TO PRE-FAB STEEL

SKETCH – RPS-10 Pre-Fabricated Steel Suction for Pump Stations

APPENDIX

APPENDIX A – VE STUDY PARTICIPANTS

VALUE ENGINEERING STUDY

PROJECT TITLE: *SELA Flood Control, Orleans Outfalls*

PROJECT LOCATION: *East Bank of Orleans Parrish, Louisiana*

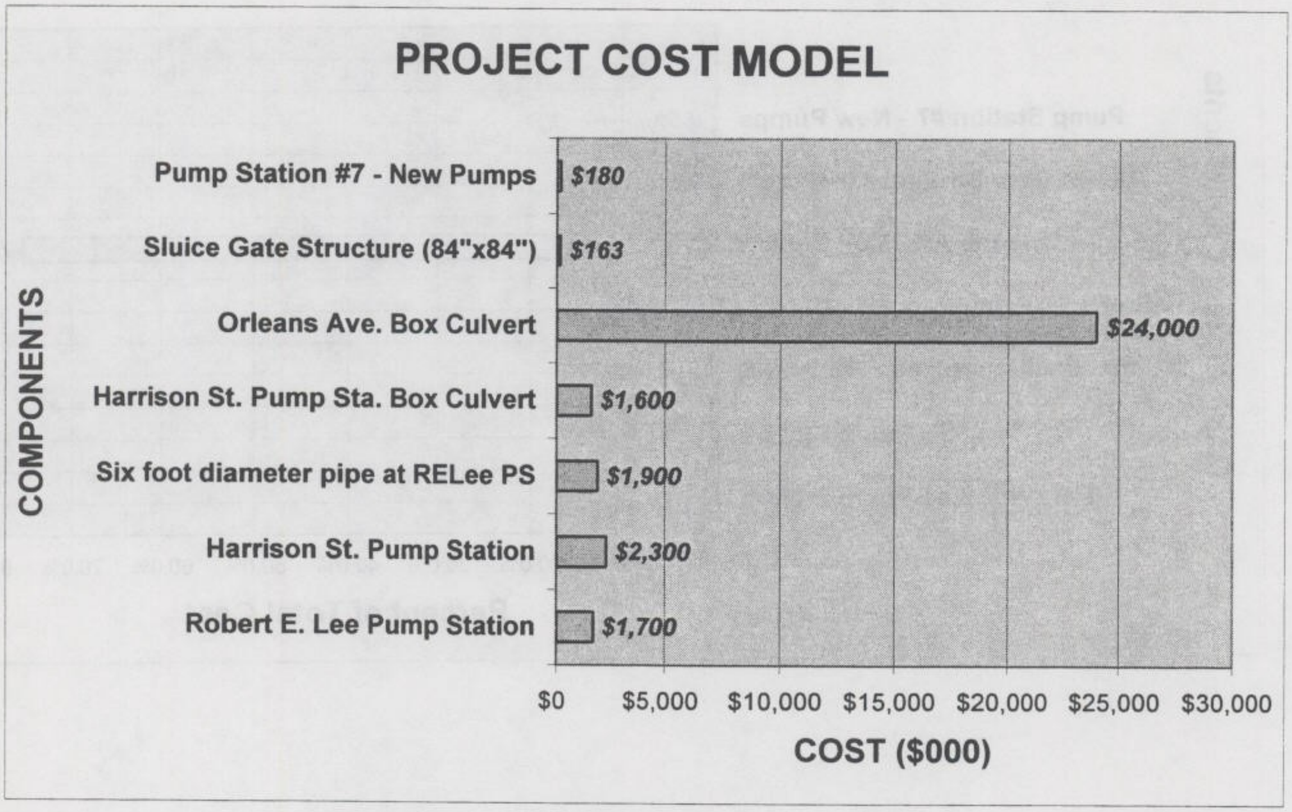
VE STUDY PARTICIPANTS

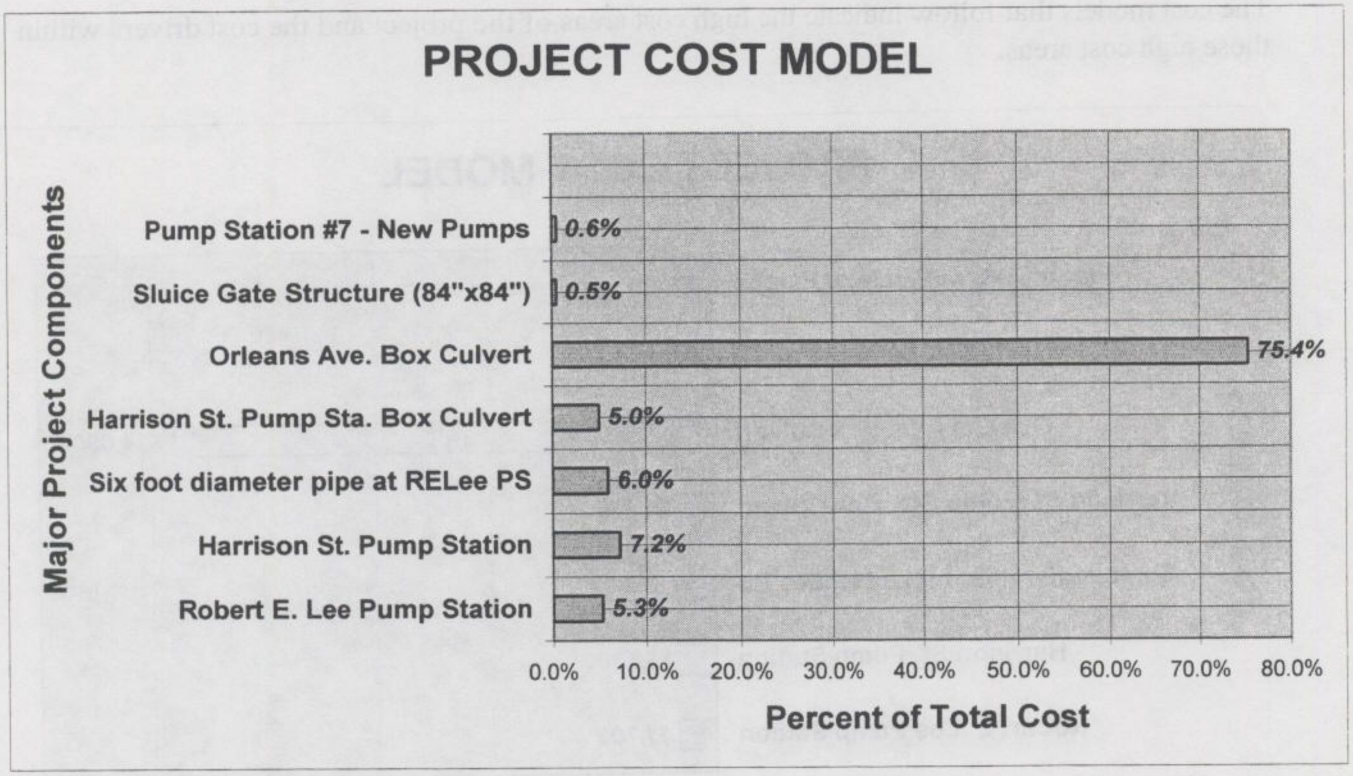
Name	Organization	Phone	VE Workshop	Design Presentation	Mid-Point Review	VE Presentation	Implementation Meeting
Wafic Ayoub	Black & Veatch	913-458-3700	√	√	√	√	
Jim Legendre	ILSI Engr.	504-455-2090	√			√	
Dan Marjalont	BCG	504-454-3866	√			√	
Navin Mehta	ILSI Engr.	504-455-2090	√			√	
Angel Mislan	COE / ED-HM	504-862-2473	√			√	
Jim Mohart	Robinson, Stafford, & Rude, Inc.	913-381-0603	√	√	√	√	
Monty Nigus	Black & Veatch	913-458-3942	√	√	√	√	
Ann Springston	BCG / S&WB PM	504-454-3866	√				
Cecil Stegman	Black & Veatch	913-458-3700	√	√	√	√	
Mark Swanson	Black & Veatch	913-458-6834	√	√	√	√	
Frank Vicidomina	COE	504-862-1251	√	√	√	√	
Bob Willet	Black & Veatch	919-462-7504	√	√	√	√	
Lori Wingate	COE	504-862-1285	√			√	

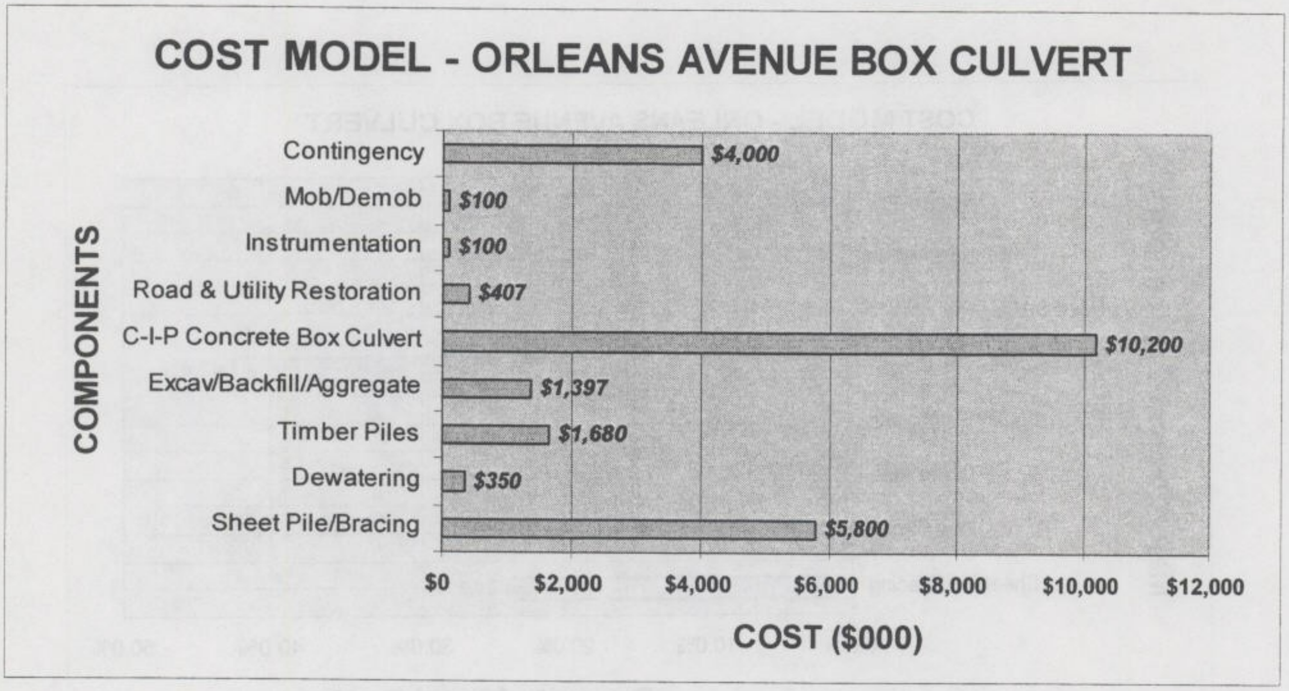
APPENDIX B – COST INFORMATION

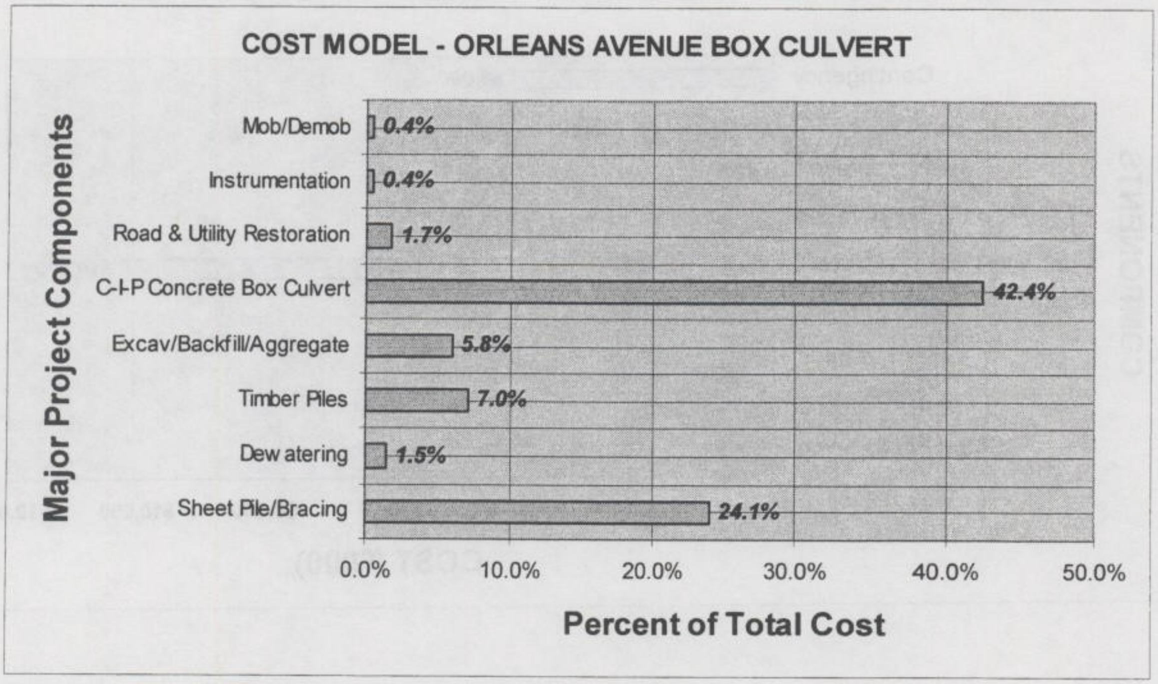
COST MODELS

The cost models that follow indicate the high cost areas of the project and the cost drivers within those high cost areas.




PROJECT COST MODEL
Major Project Components
Pump Station #7 - New Pumps
0.6%
Sluice Gate Structure (84"x84")
0.5%
Orleans Ave. Box Culvert
75.4%
Harrison St. Pump Sta. Box Culvert
5.0%
Six foot diameter pipe at RELee PS
6.0%
Harrison St. Pump Station
7.2%
Robert E. Lee Pump Station
5.3%
0.0% 10.0% 20.0% 30.0% 40.0% 50.0% 60.0% 70.0% 80.0%
Percent of Total Cost


COST MODEL - ORLEANS AVENUE BOX CULVERT
COMPONENTS
Contingency
Mob/Demob
Instrumentation
Road & Utility Restoration
C-I-P Concrete Box Culvert
Excav/Backfill/Aggregate
Timber Piles
Dewatering
Sheet Pile/Bracing
$4,000
$100
$100
$407
$10,200
$1,397
$1,680
$350
$5,800
$0
$2,000
$4,000
$6,000
$8,000
$10,000
$12,000
COST ($000)


COST MODEL - ORLEANS AVENUE BOX CULVERT
Major Project Components
Mob/Demob
0.4%
Instrumentation
0.4%
Road & Utility Restoration
1.7%
C-I-P Concrete Box Culvert
42.4%
Excav/Backfill/Aggregate
5.8%
Timber Piles
7.0%
Dew atering
1.5%
Sheet Pile/Bracing
24.1%
0.0%
10.0%
20.0%
30.0%
40.0%
50.0%
Percent of Total Cost

APPENDIX C – CREATIVE IDEA LISTING

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

CREATIVE IDEA LISTING & EVALUATION

Idea No.	Description	Votes
	GENERAL	
G-1	READDRESS COST ESTIMATE (BENEFITS & COSTS)	7
G-2	RE-VISIT ALTERNATIVE #5	3
G-3	PUMP DIRECTLY FROM SCOTT ST. TO STA #7	6
G-4	DIVERT EXCESS FLOW TO OTHER PUMP STATION	1
G-5	INCREMENTALLY JUSTIFY EACH OF THE THREE MAJOR COMPONENTS OF THE PROJECT	5
G-6	SIZE CULVERTS CONSIDERING SILTATION	3
G-7	SIZE CULVERTS BASED ON FLOW REQUIREMENTS	5
G-8	UTILIZE MAXIMUM PUMP CAPACITY	1
G-9	CONSIDER EARLY COMPLETION INCENTIVES	3
G-10	ADDRESS ADDED COST TO COVER PUMP STATION #2 DISCHARGE CANAL	3
G-11	VOID	
G-12	USE ROOF FRAMED STRUCTURE FOR SPLASH PROTECTION	1
G-13	STEEL GRATING FOR SPLASH PROTECTION	0
G-14	USE CHECKERED PLATE FOR SPLASH PROTECTION	1
G-15	COMBINE G-13 & G-14	1
G-16	GUARD RAILS IN CONJUNCTION WITH LIGHT GAGE COVERING	1
G-17	ADD COSTS FOR IMPROVED STILLING BASIN AT PUMP STATION #7	3

Idea No.	Description	Votes
G-18	CONFIRM NON-PRESENCE OF INDUCED FLOODING IN AREA 'E'	4
G-19	GATE AT CULVERT OFF CITY PARK AND ALLOW PARK TO FLOOD IN LIEU OF $24 MILLION CULVERT ON ORLEANS AVE.	2
G-20	PERFORM COMPREHENSIVE RISK AND UNCERTAINTY ANALYSIS TO INCLUDE: • POWER SUPPLY • MECHANICAL FAILURE • COINCIDENTAL HIGH TIDES • CULVERT SILTATION	3
G-21	RECONCILE CLAIBORNE CULVERT COSTS WITH REMAINDER OF PROJECT	6
G-22	DO NOTHING	3
G-23	USE DESIGN BUILD PROJECT DELIVERY SYSTEM	1
G-24	USACE TO DICTATE USE OF SUBMERSIBLE PUMPS	6
G-25	INSTALL SUBMERSIBLE PUMPS; MANUFACTURER TO MAINTAIN FOR FIRST 10 YEARS	1
G-26	TWO 100% SUBMERSIBLE PUMPS AT EACH STATION	0
G-27	TRAIN S&WB STAFF TO MAINTAIN SUBMERSIBLE PUMPS	1
G-28	TAKE S&WB STAFF ON SUBMERSIBLE PUMP STATION VISIT	1
G-29	ONE SPARE PUMP FOR ROBT. E. LEE PUMP STATION AND HARRISON ST. PUMP STATION IN CASE A PUMP FAILS	4
G-30	MAKE ALL PUMPS FOR BOTH PUMP STATIONS THE SAME SIZE	5
G-31	PUT SUBMERSIBLE PUMP IN PUMP STATION #7 AS TRIAL	2
G-32	DESIGN/BUILD/OPERATE BOTH PUMP STATIONS AND USE SUBMERSIBLE PUMPS	2
G-33	IN-LINE BOOSTER PUMPS IN ORLEANS BOX CULVERT, AND USE SMALLER DIAMETER PIPE WITH HIGHER VELOCITY FLOW	2
G-34	COMBINE G-3 & G-33	3

Idea No.	Description	Votes
G-35	REPLACE BOX CULVERT WITH FORCE MAIN TUNNEL THAT IS DEEP AND RUN STRAIGHT FROM PS#2 TO PS#7	2
G-36	DIVERT 1,000 CFS FROM PS#2 AND PUMP TO RIVER	4
G-37	GOVERNMENT URBAN RENEWAL PROJECT TO DEVELOP ROUTE FOR CONDUITS THROUGH BLIGHTED NEIGHBORHOODS	1
G-38	COMBINE EXISTING EXCAVATED MATERIAL WITH FLY-ASH AND USE AS BACKFILL	1
G-39	COMBINE EXCAVATED MATERIAL WITH FLY-ASH AND USE AS BOTTOM MATT	1
G-40	RE-EVALUATE DESIGN CRITERIA, PUBLISH, AND VALIDATE	5
G-41	ALTERNATIVE POWER SOURCES	2
G-42	RE-EVALUATE ALTERNATIVES BASED ON LIFE CYCLE COST ANALYSIS (PRESENT WORTH BASIS)	0
G-43	ALTERNATIVE MATERIALS TO REDUCE MAINTENANCE	0

Idea No.	Description	Votes
	CONCRETE BOX CULVERT	
C-1	PRECAST CONCRETE BOX CULVERT SECTIONS	4
C-2	REPLACE BOX CULVERT WITH PIPES	5
C-3	USE ALTERNATIVE PIPE MATERIALS	0
C-4	USE ARCH PIPE	3
C-5	ELLIPTICAL PIPE	0
C-6	LINE NEW CONCRETE BOX CULVERT & LOWER THE FRICTION	0
C-7	SAME AS C-6, BUT DO WITH EXISTING BOX CULVERT	1
C-8	SHOTCRETE SHEET PILING AND USE SHEET PILE AS FORM	0
C-9	USE SHEET PILING AS FORM FOR CIP CONCRETE AND DELETE TIMBER PILES	5
C-10	USE EXISTING SYSTEM, BUT JACK CULVERT UNDER ROADWAY	2
C-11	JACK AND BORE ALL THE WAY	0
C-12	USE SUPER HI-STRENGTH CONCRETE	1
C-13	USE FAST CURING CONCRETE	1
C-14	STYROFOAM FORMS	0
C-15	SLIP-FORMING	0
C-16	MASONRY WALLS	0
C-17	OPEN CHANNEL FLOW	0
C-18	SAME AS C-17, BUT IN PARK SETTING	3
C-19	UN-REINFORCED CONCRETE	0

Idea No.	Description	Votes
C-20	USE CARDBOARD FORMS	0
C-21	LARGE CMU WALLS	0
C-22	SAME AS C-21, BUT REINFORCE CMU's	0
C-23	USE WELDED WIRE FABRIC REINFORCEMENT	0
C-24	USE OLD PIPE AND LINE IN PLACE WITH EPOXY MORTAR	0
C-25	COMBINATION OPEN CHANNEL, BOX CULVERT	1
C-26	CONCRETE SHEET PILE WITH TREMIE BOTTOM	2
C-27	RUN CULVERT DOWN STREET W/TOP SLAB AS ROAD SURFACE	3
C-28	BUILD ADJACENT CHAMBER TO CARRY PARALLEL UTILITY LINES (NOW AND IN FUTURE)	0
C-29	USE UTILITY CHAMBER FROM C-28 AS DUAL FUNCTION TO DRAIN ROADWAYS	1
C-30	ELEVATED FLUME	0
C-31	FORCE MAIN	6
C-32	KEEP 1,000 CFS TO PS#3 AND REDUCE NEW BOX CULVERT CROSS SECTION	0
C-33	SHORTEN BOX CULVERT (NEW ALIGNMENT)	0
C-34	USE EXISTING BOX CULVERT	1
C-35	INCREASE CAPACITY OF EXISTING BOX CULVERT	4
C-36	SAME AS C-35, BUT SEPARATE (BUILD ON TOP)	1
C-37	MAKE EXISTING BOX CULVERT WIDER BY BUILDING NEW ONE ADJACENT TO IT	4
C-38	PUT NEW CULVERT ON TOP OF EXISTING, BUT MAKE WIDER	0

Idea No.	Description	Votes
C-39	SAME AS C-38, BUT OPEN TOP	0
C-40	OPEN CHANNEL LINED WITH RIP-RAP OR INTERLOCKING BLOCK	1
C-41	RIP-RAP BOTTOM	0
C-42	STABILIZE BOTTOM WITH GEOTEXTILES	0
C-43	ELIMINATE TIMBER PILING	5
C-44	CONSTRUCT BOX CULVERT FROM PRECAST WALLS, TOP, FLOOR, ETC.	0
C-45	INSTALL CONCRETE PRESSURE RELIEF VALVES; DO NOT DESIGN FOR FLOTATION	0
C-46	EXTEND HEEL ON BOTTOM SLAB TO REDUCE CONCRETE VOLUME	3
C-47	GRATING ON TOP	0
C-48	CONSTRUCT STORAGE BASIN UNDERGROUND	0
C-49	USE WATER-WORKS PARK AS RETENTION POND	3
C-50	INSTALL CONDUIT DEEP AS TUNNEL	0
C-51	LEVEE AROUND LAKE-INCREASE STORAGE VOLUME	2
C-52	CONSTRUCT STORAGE RESERVOIR UNDER LAKE IN PARK	0
C-53	DEEP WELL INJECTION FOR STORAGE	0
C-54	BUILD LAKES IN LOW SPOTS FOR STORAGE	4
C-55	CONSTRUCT STORAGE WITH CAISSON TECHNIQUE	0
C-56	BACKFILL WITH NATIVE SOIL	0
C-57	USE SPOILS TO FILL IN LOW SPOTS	1
C-58	USE FILL TO INCREASE LEVEE HEIGHTS	0

Idea No.	Description	Votes
C-59	USE 'H' PILES WITH HIGH CAPACITY	0
C-60	USE PIPE PILES	0
C-61	USE CONCRETE PILES	0
C-62	AUGER CAST PILES	0
C-63	GROUT INJECTION TO STABILIZE BOTTOM AND ELIMINATE PILES	0
C-64	ELIMINATE PILES	6
C-65	REPLACE PILES WITH GEOTEXTILE FABRIC AND CRUSHED STONE.	1
C-66	JACK AND BORE PIPE (CONCRETE)	0
C-67	JACK AND BORE STEEL PIPE (CONCRETE LINE INSIDE AND OUT)	0
C-67	USE BARRIER WALL FOR SPLASH PROTECTION DOWNSTREAM FROM PUMP STATION #2	2

Idea No.	Description	Votes
	ROBERT E. LEE PUMPING STATION	
RPS-1	MAKE SUBMERSIBLE PUMP STATION	6
RPS-2	USE HYDRAULIC DRIVEN SUBMERSIBLE PUMPS	3
RPS-3	USE NATURAL GAS DRIVES (See RPS-18)	3
RPS-4	GATE VALVES AT STRUCTURE AND BIFURCATE LINE BEYOND VALVES	2
RPS-5	LOCATE PUMP STATION WHERE 72" PIPE STARTS, THEN PUMP EAST TO CANAL	5
RPS-6	DON'T EVEN THINK ABOUT GOING DOWN ALLEY	5
RPS-7	ROUTE SUCTION LINE DOWN NEAREST STREET THAT NEEDS REPAIR	2
RPS-8	REDUCE STATION SIZE TO 100 CFS	7
RPS-9	JACK AND BORE SUCTION LINE	2
RPS-10	USE STEEL FORMED SUCTION LINE	4
RPS-11	USE SHEET PILING AS OUTER FORM FOR CONCRETE WALLS BELOW GRADE	1
RPS-12	DRY STACK CMU's FOR SUPERSTRUCTURE	0
RPS-13	PREFABRICATE AND PRE-WIRED SUPER STRUCTURE	0
RPS-14	ADD CONVEYORS TO REMOVE SCREENINGS	0
RPS-15	BACKWASH SYSTEM FOR SCREENS	3
RPS-16	NO SUPERSTRUCTURE; USE OUTDOOR EQUIPMENT	1
RPS-17	LOWER PUMP STATION AND MAKE WATER-PROOF	0
RPS-18	CONSIDER BACK-UP ELECTRICAL	4

Idea No.	Description	Votes
RPS-19	SINGLE PUMP IN PUMP STATION	3
RPS-20	ADD CCTV VIDEO MONITORING TO PUMP STATIONS	6
RPS-21	USE ALTERNATIVE PIPE MATERIALS FOR DISCHARGE PIPE	2
RPS-22	ELIMINATE FITTINGS IN DISCHARGE LINE	0
RPS-23	ELIMINATE DISCHARGE LINE; BUILD PUMP STATION IN LEVEE	0
RPS-24	USE CAN PUMPS	1
RPS-25	FREE FLOW OVER LEVEE WALL	1
RPS-26	CIRCULAR PUMP STATION; CIP CONCRETE OR CIRCULAR PIPE SECTIONS. CAISSON CONSTRUCTION.	2
RPS-27	USE SIPHON AND ELIMINATE PUMP STATION	0
RPS-28	SINGLE VARIABLE SPEED PUMP	0
RPS-29	USE CENTRIFUGAL PUMPS; WET PIT – DRY PIT TYPE	0
PRS-30	SCREW PUMPS ON SIDE OF LEVEE AND PUMP OVER LEVEE	3
PRS-31	INCREASE CAPACITY OF PS#12 AND DELETE ROBT. E. LEE PS	5
PRS-32	IMPROVE HYDRAULIC EFFICIENCY OF SYSTEM AND ELIMINATE NEED FOR PUMP STATIONS	0
PRS-33	ELIMINATE PIPE SUPPORTS; LAY PIPE ON GRADE	0
PRS-34	SMALLER SCREEN SPACINGS AT PUMP STATIONS	0
PRS-35	USE NEW HI-TECH SCREENINGS REMOVAL DEVICE	0
PRS-36	MOVE THE PUMP STATION TO ANOTHER LOCATION	0
RPS-37	DOG HOUSE AROUND PUMPS; NO SUPERSTRUCTURE	1
RPS-38	REPLACE 6 FOOT DIAM. WITH 2 SMALLER CONCRETE PIPES	0
RPS-39	USE HOBAS, HDPE, OR PVC PIPE	5

VALUE ENGINEERING STUDY

Idea No.	Description	Votes
RPS-40	SAME AS HARRISON ST. WHERE APPLICABLE	0
RPS-41	LOWER RPS AND HPS TO GROUND LEVEL	0

Idea No.	Description	Votes
	HARRISON AVENUE PUMPING STATION	
HPS-1	REDUCE CAPACITY TO 200 CFS	6
HPS-2	LOCATE STATION AT FLEUR de LIS AND USE FORCE MAIN TO CONVEY FLOW TO CANAL	6
HPS-3	REPLACE BOX CULVERTS WITH PIPE	6
HPS-4	SAME AS FOR ROBT. E. LEE PS WHERE APPROPRIATE	0
HPS-5	REPLACE CIP CONCRETE CULVERT WITH PRECAST	3
HPS-6	BURIED PUMP STATION; USE IN-LINE PUMPS	0
HPS-7	USE PROPELLER PUMP IN-LINE	0
HPS-8	COMBINE BOTH PUMP STATIONS	1
HPS-9	USE ONE PUMP	2
HPS-10	LOWER RPS AND HPS TO GROUND LEVEL	0

Idea No.	Description	Votes
	SHEET PILING	
SP-1	FREEZE GROUND	0
SP-2	TREMIE IN BOTTOM IN THE WET	4
SP-3	USE DIFFERENT ALIGNMENT	0
SP-4	TRENCHLESS TECHNOLOGY	3
SP-5	REPLACE INTERNAL BRACING WITH TIE-BACKS	0
SP-6	USE CONCRETE SHEET PILE	1
SP-7	USE TIMBER SHEET PILING	0
SP-8	CANTILEVERED SHEET PILES	0
SP-9	REPLACE SHEET PILES WITH TRENCH BOX	0
SP-10	OPEN CUT	1
SP-11	INTEGRATE SHEET PILE & CULVERT WALL – LEAVE IN PLACE	1
SP-12	USE VINYL SHEET PILE	0
SP-13	USE DRILLING MUD TO STABILIZE SOIL	0
SP-14	ABOVE GRADE CONDUIT	0
SP-15	CONCRETE SLURRY WALL	0
SP-16	SAME AS SP-14, BUT USE TOP OF CONDUIT FOR BIKE PATH	1
SP-17	CAISSON CONSTRUCTION	1
SP-18	GROUT INJECTION	0
SP-19	BOBCAT EXCAVATION	1
SP-20	PREVENT RAINFALL OR COVER NEW ORLEANS	0

Idea No.	Description	Votes
SP-21	COLLECT GROUND WATER AT EACH RESIDENCE	0
SP-22	CONSTRUCT STORAGE BASIN TO SHAVE PEAKS	0

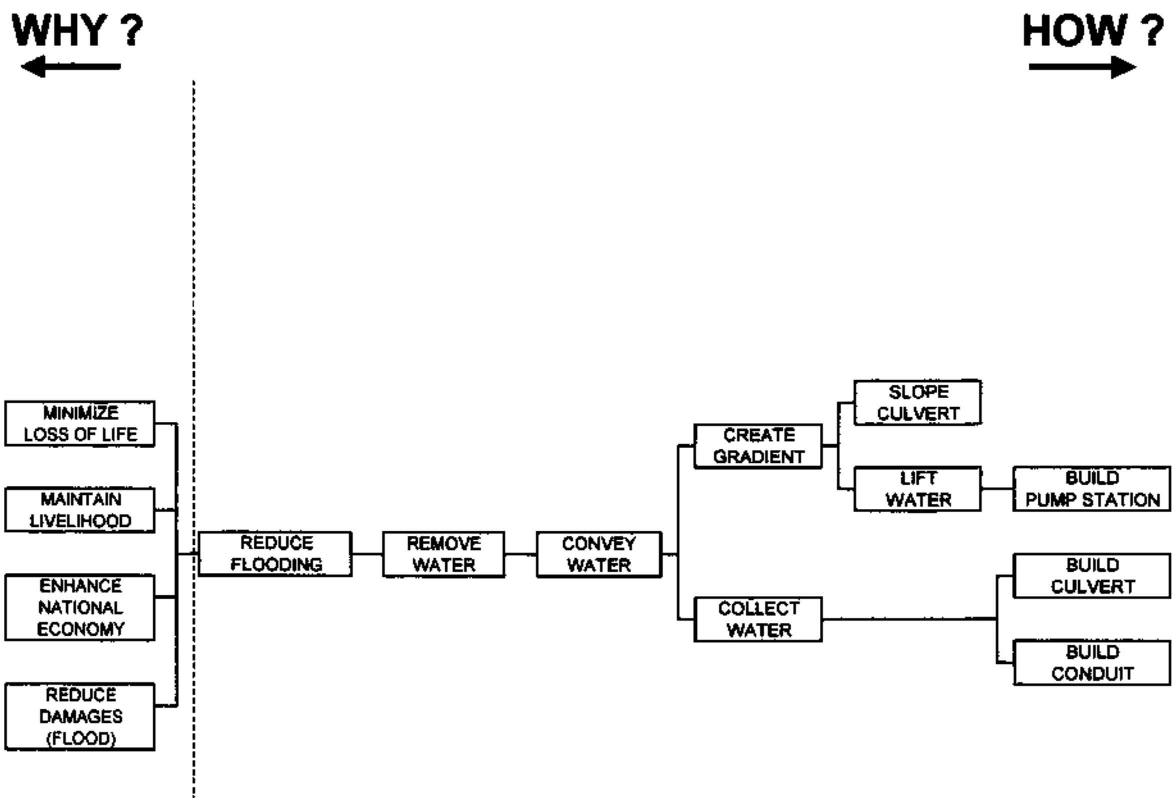
APPENDIX D –MATERIALS FURNISHED

STUDY MATERIALS FURNISHED

1. Concept Design Cost Estimate – File: C:\PROJECTS\90195\COST-EST\ORELANS.WK3
2. Drainage Pump Stations Map, Sep 1, 1998, by BCG
3. Orleans Parish Section 553(d) Study
4. Project Description titled, "SUBBASIN D-E, ORLEANS AND LONDON AVES. SUBBASIN – DESCRIPTION OF THE PROPOSED ACTION – OPTIMIZED PLAN"
5. Table 1. ORLEANS PARISH STUDY, ORLEANS AVE & LONDON AVE SUBBASIN (AREA D-E)
6. Drawings:
   - Typical Plan and Section through Harrison Ave. Drainage Pumping Station
   - Typical Plan of Robert E. Lee Drainage Pumping Station
   - Typical Section through Robert E. Lee Drainage Pumping Station
   - Orleans Ave. Concrete Box Culvert Cross Section (N. Scott St. to DPS #7)
7. Map: Orleans Parish drainage basins.
8. Abstract of Bids – Construction, Southeast Louisiana Urban Flood Control Project
9. Orleans Feasibility Study, Orleans Avenue Canal, Alternative 3, Revision 20, 22-Jan-99
10. Map: Sub-Basin "D", Storage Areas and Sub-Areas
11. Map: Orleans Ave. Canal Structure Inventory
12. Project Area Maps by BCG & ILSI:
    - Existing and proposed canals between DPS #2 and DPS#7
    - Robert E. Lee DPS and influent line
    - Harrison Ave. DPS and influent line

APPENDIX E – FUNCTION ANALYSIS

FUNCTION ANALYSIS



FAST Diagram: SELA Flood Control, Orleans Outfalls

APPENDIX F –SUBMERSIBLE PUMP INFORMATION

VALUE ENGINEERING STUDY

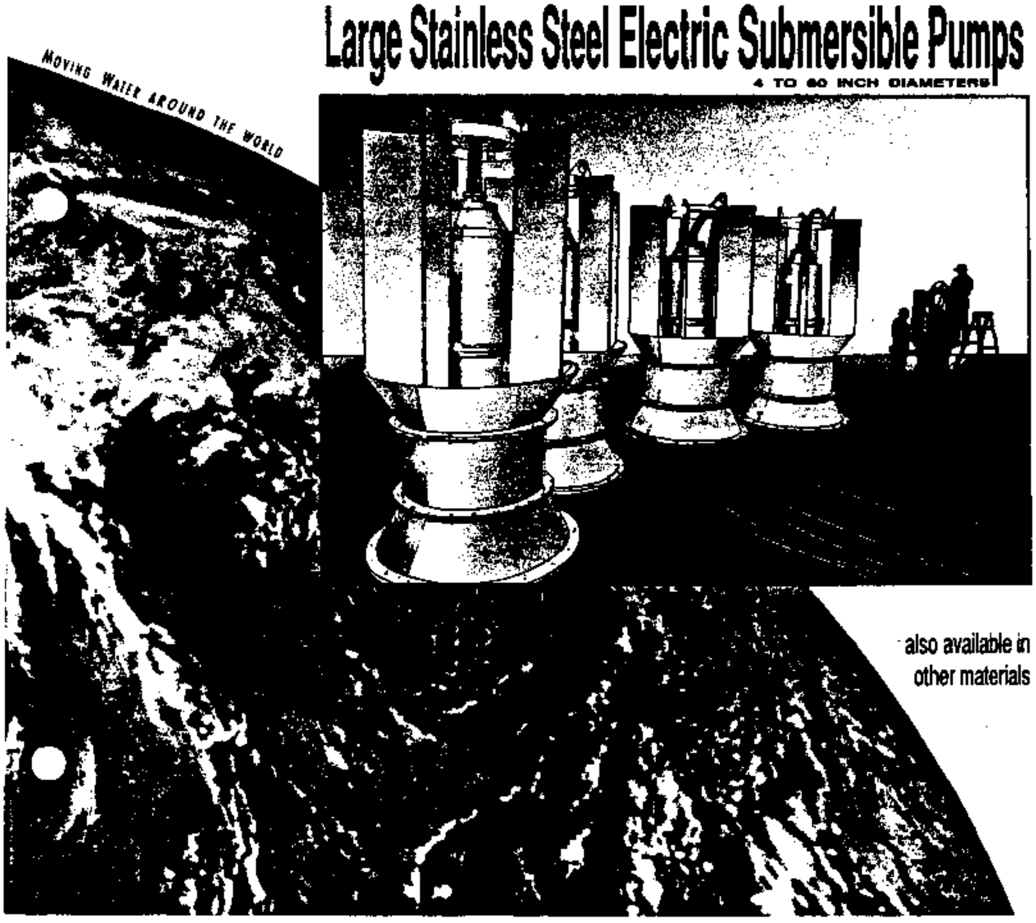
PROJECT TITLE: SELA Flood Control, Orleans Outfalls

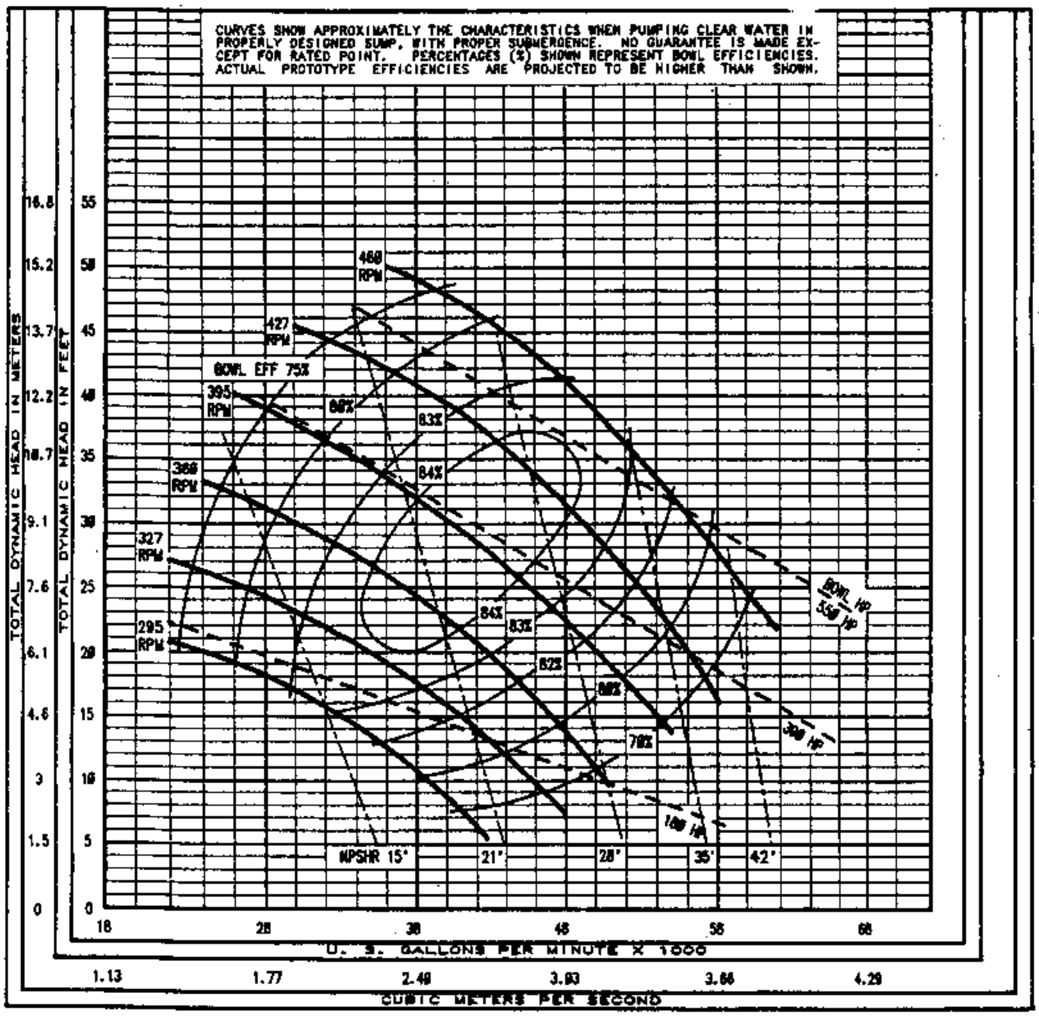
PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

SUBMERSIBLE PUMP INFORMATION

- STORM DRAINAGE
- FLOOD IRRIGATION
- ENVIRONMENTAL CLEAN-UP
- SEWAGE EFFLUENT PUMPING
- FLOOD CONTROL
- WATER TREATMENT SYSTEMS
- CONSTRUCTION DEWATERING
- INDUSTRIAL PROCESS PUMPING
- OPEN PIT MINING DEWATERING
- AQUACULTURE

M&W PUMP CORP.
SINCE 1928





PUMP PERFORMANCE CURVE VARIABLE SPEED	
TYPE: MIXED FLOW	PROPELLER DIA: 39.75"
MODEL NO: MF 46-5700B	SPEED (RPM): AS NOTED
INTAKE DIA: 64"	DISCHARGE COLUMN DIA: 48"
CURVE NO: N4857B - RPM	Ns: 5700 CODE: B

SINGLE STAGE
FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 2.0 AND EFFICIENCY BY 1.0 .

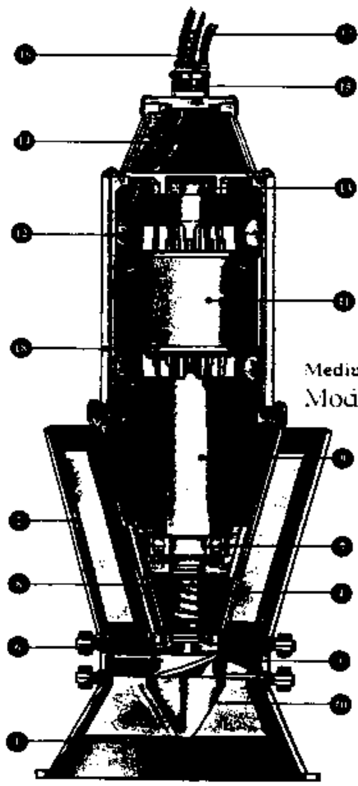
PERFORMANCE BASED ON PUMPING CLEAR COLD NON-AERATED WATER, SPECIFIC GRAVITY 1.0, TEMPERATURE 85 DEGREES (FAHRENHEIT) OR LESS, AT SEA LEVEL. PERFORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITIES, ALTITUDES AND SUMP CONDITIONS.

M & W PUMP CORPORATION
33 N. W. 2nd STREET
DEERFIELD BEACH
FLORIDA 33441
U. S. A.
ESTABLISHED 1926

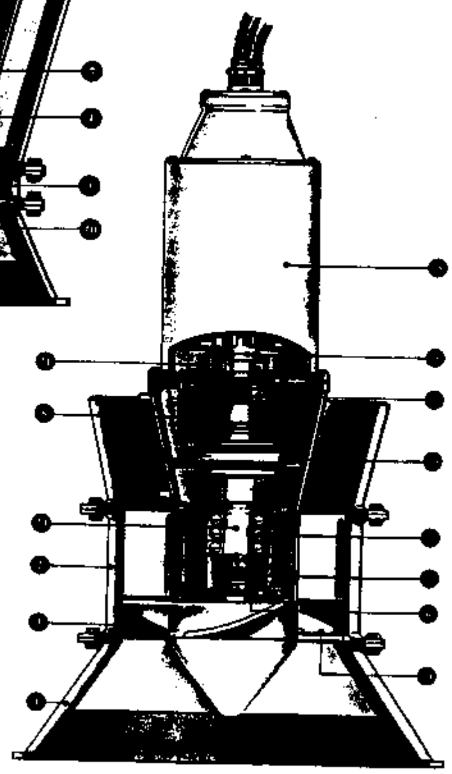
IT IS CERTIFIED THAT THE CURVES REPRESENT TRUE PERFORMANCE CHARACTERISTICS OF THE M&W PUMP MODEL AND WERE OBTAINED BY SCALE MODEL TESTS AND CALCULATIONS IN ACCORDANCE WITH HYDRAULIC INSTITUTE STANDARDS.

M & W PUMP CORPORATION
CERTIFICATION
AVAILABLE UPON REQUEST

VALUE ENGINEERING STUDY

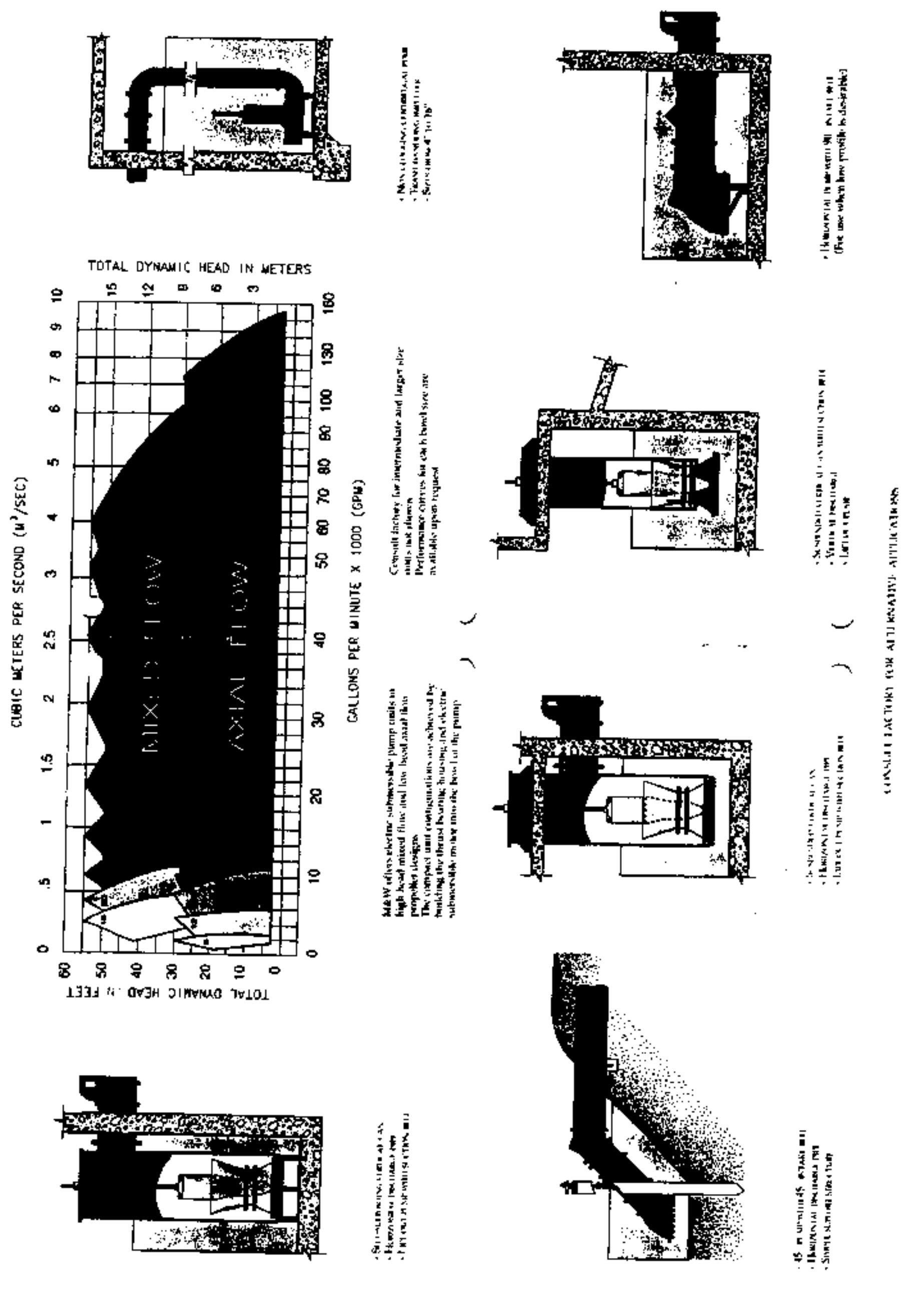


Medium Speed Unit
Model MS



Low Speed Unit
Model LS

1. Intake bell with guide vanes
2. Pump bowl assembly with flow straightening vanes
3. Optional replaceable liner
4. Double mechanical seal (optional materials available)
5. Single mechanical seals (optional materials available)
6. Seal protector
7. Heavy duty thrust bearing (high L10 life)
8. Moisture detection probe
9. Heavy duty shaft with extra safety factor
10. Propeller with taper lock attachment
11. Dynamically balanced rotor
12. Stator windings with thermal protection
13. Upper support bearing (high L10 life)
14. Wire connection chamber, junction box
15. Double cable seal
16. Heavy insulated power cable
17. Control cable
18. Motor housing
19. Speed reducer assembly
20. Pump bowl shaft
21. Intermediate support bearing



CUBIC METERS PER SECOND (M³/SEC)
TOTAL DYNAMIC HEAD IN METERS
TOTAL DYNAMIC HEAD IN FEET
GALLONS PER MINUTE X 1000 (GPM)
MIXED FLOW
AXIAL FLOW

Pump Intake Design

9.8 Pump intake design

Metric units of measurement are used; and corresponding US units appear in brackets. Charts, graphs and sample calculations are also shown in both metric and US units.

Since values given in metric units are not exact equivalents to values given in US units, it is important that the selected units of measure be stated in reference to this standard. If no such statement is provided, metric units shall govern. See Section 9.8.8 for Glossary and Nomenclature.

In the application of this standard, the pump rated flow shall be used as the design flow for the basis of the intake design.

9.8.1 Design objectives

Specific hydraulic phenomena have been identified that can adversely affect the performance of pumps. Phenomena that must not be present to an excessive degree are:

- Submerged vortices
- Free-surface vortices
- Excessive pre-swirl of flow entering the pump
- Non-uniform spatial distribution of velocity at the impeller eye
- Excessive variations in velocity and swirl with time
- Entrained air or gas bubbles

The negative impact of each of these phenomena on pump performance depends on pump specific speed and size, as well as other design features of the pump that are specific to a given pump manufacturer. In general, large pumps and axial flow pumps (high specific speed) are more sensitive to adverse flow phenomena than small pumps or radial flow pumps (low specific speed). A more quantitative assessment of which pump types may be expected to withstand a given level of adverse phenomena with no ill effects has not been performed. Typical symptoms of adverse hydraulic conditions are reduced flow rate, head, effects on power, and increased vibration and noise.

The intake structure should be designed to allow the pumps to achieve their optimum hydraulic performance for all operating conditions. A good design ensures that the adverse flow phenomena described above are within the limits outlined in Section 9.8.5.6.

If an intake is designed to a geometry other than that presented in this standard, and this design is shown by prototype or model tests, performed in accordance with Section 9.8.5, to meet the acceptance criteria in Section 9.8.5.6, then this alternative design shall be deemed to comply with this standard.

9.8.2 Intake structures for clear liquids

9.8.2.1 Rectangular intakes

This section is applicable to wet pit pumps. This section also applies to the intakes for dry pit pumps with less than five diameters of suction piping immediately upstream from the pump (see Section 9.8.4).

9.8.2.1.1 Approach flow patterns

The characteristics of the flow approaching an intake structure is one of the most critical considerations for the designer. When determining direction and distribution of flow at the entrance to a pump intake structure, the following must be considered:

- The orientation of the structure relative to the body of supply liquid
- Whether the structure is recessed from, flush with, or protrudes beyond the boundaries of the body of supply liquid
- Strength of currents in the body of supply liquid perpendicular to the direction of approach to the pumps
- The number of pumps required and their anticipated operating combinations

The ideal conditions, and the assumptions upon which the geometry and dimensions recommended for rectangular intake structures are based, are that the structure draws flow so that there are no cross-flows in the vicinity of the intake structure that create asymmetric flow patterns approaching any of the pumps, and

HI Pump Intake Design — 1998

the structure is oriented so that the supply boundary is symmetrical with respect to the centerline of the structure. As a general guide, cross-flow velocities are significant if they exceed 50% of the pump bay entrance velocity. Section 9.8.5 provides recommendations for analyzing departures from this ideal condition based upon a physical hydraulic model study.

9.8.2.1.2 Open vs. partitioned structures

If multiple pumps are installed in a single intake structure, dividing walls placed between the pumps result in more favorable flow conditions than found in open sumps. Adverse flow patterns can frequently occur if dividing walls are not used. For pumps with design flows greater than 315 l/s (5,000 gpm) dividing walls between pumps are required.

9.8.2.1.3 Trash racks and screens

Partially clogged trash racks or screens can create severely skewed flow patterns. If the application is such that screens or trash racks are susceptible to clogging, they must be inspected and cleaned as frequently as necessary to prevent adverse effects on flow patterns.

Any screen-support structure that disrupts flow, such as dual-flow traveling screens, otherwise known as double-entry single-exit screens, can create a high-velocity jet and severe instability near the pumps. A physical hydraulic model study must be performed in every such case. The screen exit should be placed a minimum distance of six bell diameters, 6D, (see Section 9.8.6) from the pumps. However, this distance should be used only as a general guideline for initial layouts of structures, with final design developed with the aid of a physical model study.

The recommendations in this standard should be followed if suction bell strainers are used.

9.8.2.1.4 Recommendations for dimensioning rectangular intake structures

The basic design requirements for satisfactory hydraulic performance of rectangular intake structures include:

- Adequate depth of flow to limit velocities in the pump bays and reduce the potential for formulation of surface vortices
- Adequate pump bay width, in conjunction with the depth, to limit the maximum pump approach velocities to 0.5 m/s (1.5 ft/s), but narrow and long enough to channel flow uniformly toward the pumps

The minimum submergence, S, required to prevent strong air core vortices is based in part on a dimensionless flow parameter, the Froude number, defined as:

$$F_D = V/(gD)^{0.5} \qquad (9.8.2.1\text{-}1)$$

Where:

F_D = Froude number (dimensionless)

V = Velocity at suction inlet = Flow/Area, based on D

D = Outside diameter of bell or pipe inlet

g = gravitational acceleration

Consistent units must be used for V, D and g so that F_D is dimensionless. The minimum submergence, S, shall be calculated from (Hecker, G.E., 1987),

$$S = D(1+2.3F_D) \qquad (9.8.2.1\text{-}2)$$

where the units of S are those used for D. Section 9.8.7 provides further information on the background and development of this relationship.

It is appropriate to specify sump dimensions in multiples of pump bell diameters "D" (see Section 9.8.6). Basing dimensions on "D" ensures geometric similarity of hydraulic boundaries and dynamic similarity of flow patterns. There is some variation in bell velocity among pump types and manufacturers. However, variations in bell inlet velocity are of secondary importance to maintaining acceleration of the flow and converging streamlines into the pump bell.

The basic recommended layout for rectangular sumps, dimensioned in units of pump bell diameter "D," is shown in Figure 9.8.1. The dimension variables and their recommended values are defined in Table 9.8.1.

Through-flow traveling screens generally do not clog to the point where flow disturbances occur. Therefore, they may be located such that Y is 4.0D or more in dimension. For non-selfcleaning trash racks or stationary screens, the dimension Y shall be increased to a minimum of 6.0D. Care must be taken to ensure that clogging does not occur to the extent that large non-uniformities in the pump approach flow will be generated.

HI Pump Intake Design — 1998

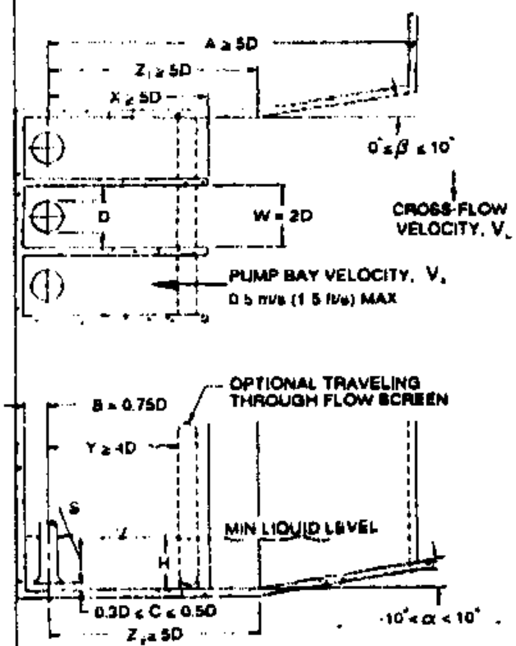


Figure 9.8.1 — Recommended intake structure layout

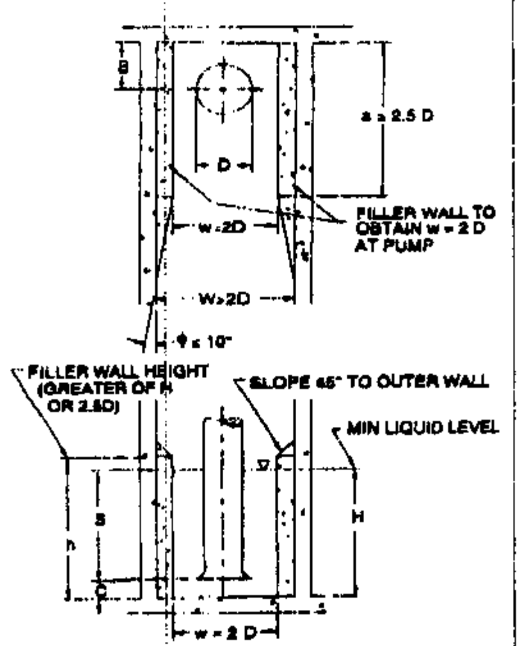


Figure 9.8.2 — Filler wall details for proper bay width

The effectiveness of the recommended pump bay dimensions depends upon the characteristics of the flow approaching the structure, and upon the geometry of hydraulic boundaries in the immediate vicinity of the structure. Section 9.8.2.1.1 provides a discussion of the requirements for satisfactory approach flow conditions.

Negative values of β (the angle of wall divergence) require flow distribution or straightening devices, and should be developed with the aid of a physical hydraulic model study.

Occasionally, it is necessary to increase the bay width to greater than 2D to prevent velocities at the entrance to the pump bays from exceeding 0.5 m/s (1.5 ft/s). Greater bay widths may also result due to the arrangement of mechanical equipment. In these cases, the bay width in the immediate vicinity of the pumps must be decreased to 2D. The dimension of the filler required to achieve the reduction in bay width is as shown in Figure 9.8.2.

For pumps with design flows of 315 l/s (5,000 gpm) or less, no partition walls between pumps are required, and the minimum pump spacing shall be 2D.

Table 9.8.2 provides a sequence of steps to follow in determining the general layout and internal geometry of a rectangular intake structure.

9.8.2.2 Formed suction intakes

9.8.2.2.1 General

This standard applies to formed suction intakes. The standard utilizes the "TYPE 10" design developed by the US Army Corps of Engineers (ETL No. 110-2-327). The formed suction intake (FSI) may eliminate the need for the design of sumps with approach channels and appurtenances to provide satisfactory flow to a pump. The FSI design is relatively insensitive to the direction of approach flow and skewed velocity distribution at its entrance. In applying the FSI design, consideration should be given to the head loss in the FSI which will affect to some extent the system curve calculations, and the net positive suction head (NPSH) available to the pump impeller, typically located near the FSI exit.

9.8.2.2.2 Dimensions

The FSI design dimensions are indicated in Figure 9.8.3. The wall shown in Figure 9.8.3 above the FSI

APPENDIX G –HYDRAULIC PUMP DRIVES

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

HYDRAULIC PUMP DRIVES

M&W

RESIDENTIAL DRAINAGE CONTROL

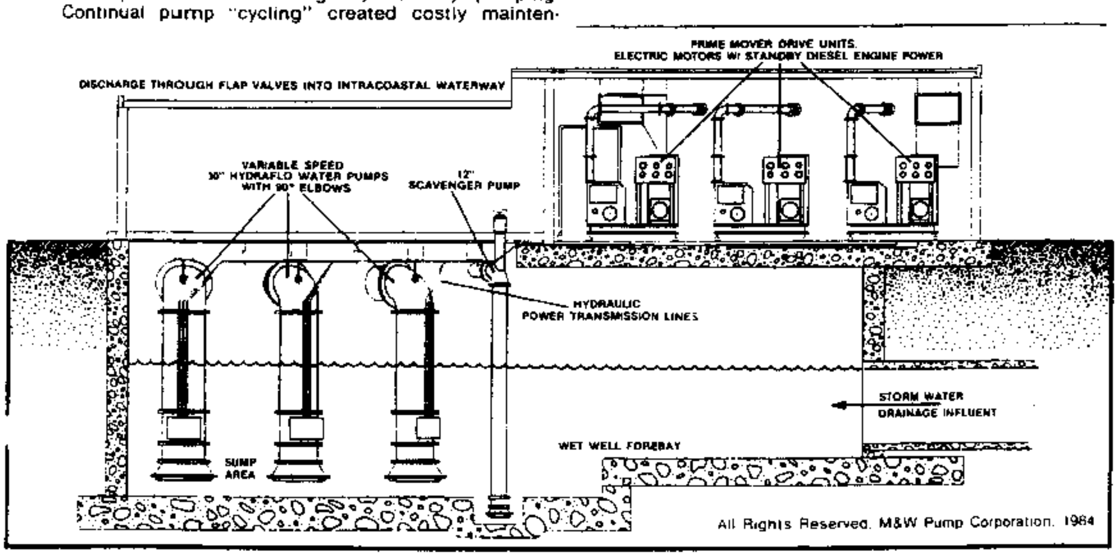
M&W PUMP CORPORATION

COST EFFECTIVE PUMPING EQUIPMENT SELECTION IS KEY TO SUCCESS FOR TOWN OF PALM BEACH, FLORIDA

Without question, one of the most beautiful and exclusive residential communities in the United States is the Town of Palm Beach in southern Florida.

Like so many seashore cities and towns, Palm Beach had critical needs for a more reliable drainage system to give them improved stormwater flood protection.

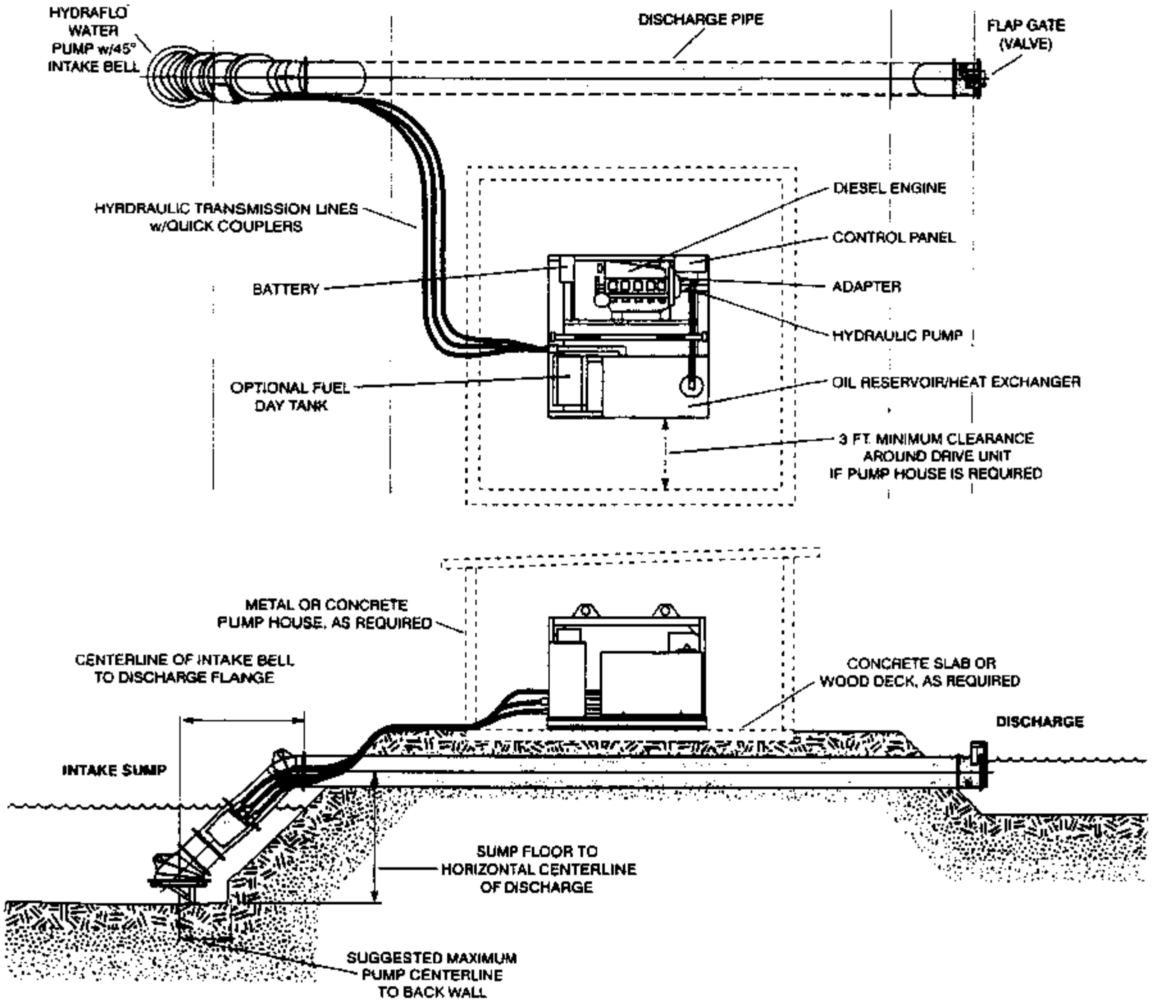
Geographically, the town is located on a narrow island, with the Atlantic Ocean in the east and bordered on the west side by the Intracoastal Waterway. Such a location exposed residents frequently to heavy tropical storm deluges and ocean tidal changes that prevented gravity drainage, making pumping a necessity. Several areas of the town did not have "pumping" protection, partly because of the limited availability and large area needed for a conventional style of pumping station. Existing pump stations utilized fixed capacity and constant speed conventional "lineshaft" type propeller pumps, which were *not* capable of responding to the *ever* varying flow conditions being encountered; nor were there provisions for emergency standby pumping. Continual pump "cycling" created costly maintenance with very limited service reliability. Having these recurring and serious drainage problems, the town engaged the consulting firm, Mock Roos and Associates, West Palm Beach, Florida to study and re-design some of their pumping stations, plus some new ones, in order to give residents more positive and reliable water control.



MWI CORPORATION
ESTABLISHED 1926

Moving Water Industries Corporation

TYPICAL APPLICATION FOR
SINGLE DIESEL DRIVE UNIT
WITH 45 DEGREE HYDRAFLO® WATER PUMP



201 North Federal Hwy., Deerfield Beach, Florida 33441 USA Phone: (954) 426-1500 Fax: (954) 426-1582

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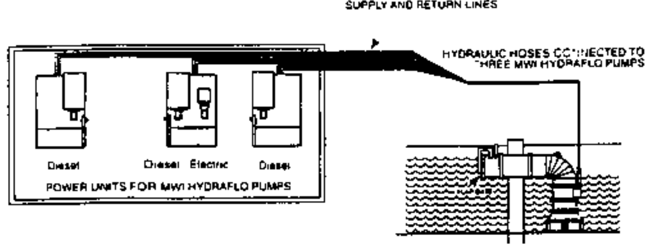
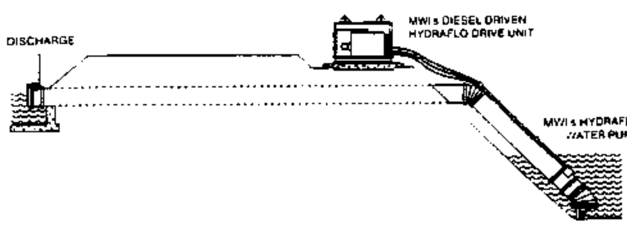
VALUE ENGINEERING STUDY

INSTALLATION OPTIONS

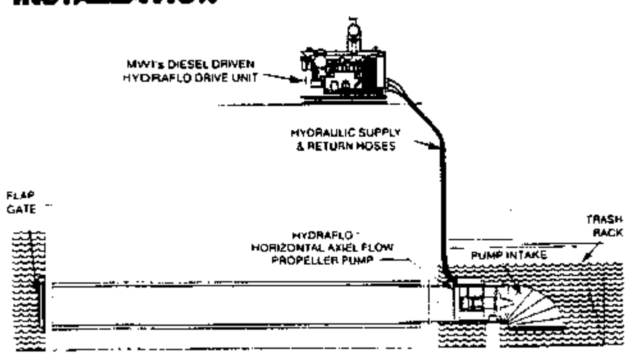
VERTICAL INSTALLATION



ANGLE INSTALLATION



HORIZONTAL INSTALLATION



HYDRAFLO ADVANTAGES

VERSATILITY

Hydraflo pumps can be installed at any angle, e.g., vertical, horizontal or at any angle in between, by simply changing the intake bell. They can pump in both directions for a two-way operation if needed. For higher head applications two Hydraflos can be staged together by bolting one on top of the other. In addition, one prime mover might also be used to drive several different pumps, thereby exemplifying the versatility and convenience of a Hydraflo installation

SLASH INSTALLATION TIME

Since hydraflo pumps do not require any critical alignment as do conventional shaft pumps, they can be installed within a fraction of the time of conventional line shaft pumps

DESIGNED FOR LONGER LIFE

Propeller blades can be manufactured from ASTM A316 corrosion /abrasion resistant stainless steel material, operating within a stainless steel liner. Any parts subject to wear i.e., the propeller, liner and bearings etc. are designed to be changed in the field in a very short amount of time with conventional hand tools

LESS SUBMERGENCE REQUIRED

Because the standard design of MWI Hydraflo pumps have large intake passages and low speeds, they can be installed and operated continuously at minimal submergences - from one half to one third of conventional pumps

REQUIRES LESS MAINTENANCE AND COSTS LESS TO OPERATE

The Hydraflo does not require special lubrication. It is hydraulically driven through a short internal shaft and permanently lubricated, with bearings directly connected to a hydraulic motor completely sealed to operate maintenance free under water. There are no priming problems and no need to worry about the pump running dry... Hydraflo pumps are designed to run dry without damage to their components. There are no belts to align, tighten or replace and no gear boxes or open shafts with the Hydraflo pumps.

COST SAVINGS INSTALLATION

Manual or completely automatic variation of propeller pump speed is accomplished by engine speed or oil volume regulation, making the Hydraflo pump ideal for varying flow or head conditions. Level sensing can be keyed automatically to system flows, pump capacities and speeds

SAFER

Lack of open high speed pulleys, "flapping" belts, special angle gears, as well as the elimination of unstable "temporary" installations subject to undermining, etc. make the Hydraflo pump much safer to operate. Also the hydraflo is more easily adaptable to use with varying site conditions than any other high capacity pump known

APPENDIX H – HDPE PIPE

VALUE ENGINEERING STUDY

PROJECT TITLE: SELA Flood Control, Orleans Outfalls

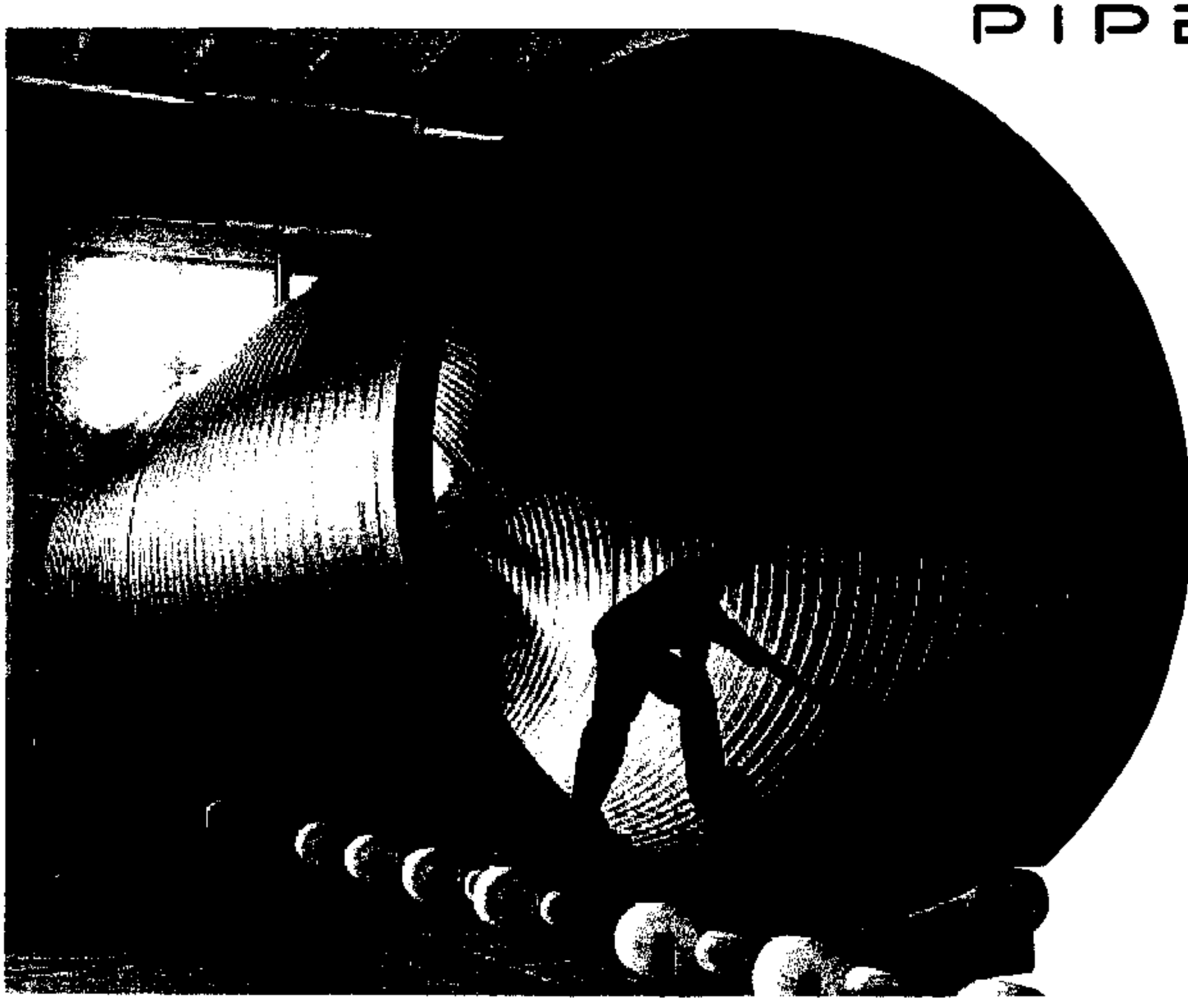
PROJECT LOCATION: East Bank of Orleans Parrish, Louisiana

HDPE Pipe

WEHOLITE

Versatile lightweight pipe system for gravity and low-pressure applications

KWH PIPE



Weholite

Lightweight Pipe System

Polyethylene is recognized by clients and engineering consultants as the ideal pipe material for many pressure and non-pressure applications such as water distribution, gravity sewers, rehabilitation projects and manholes, as well as for marine pipeline applications.

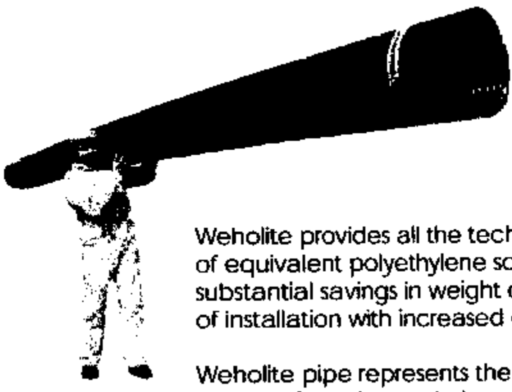
Recognizing clients' needs for large diameter, lightweight, low-pressure pipe and fittings, KWH Pipe developed Weholite, a pipe constructed using a patented structured wall process, making it possible to manufacture pipe up to 120 inches inside diameter.

Polyethylene has outstanding advantages over conventional materials, such as:

- corrosion resistance
- non toxic
- long service life
- light weight
- flexibility
- impact strength
- weldability
- abrasion resistance

Typical Resin Properties for Weholite Pipe (73 °F)

Typical Material Property	Standard	Value	Unit
Density (Compounded)	ASTM D1505	0.955	gm/cm^3
Melt Index (Pipe Condition 190/21.6)	ASTM D1238	7.5	gm/10min
Secant Flexural Modulus (2% Strain)	ASTM D790	118,000	psi
Tensile Strength at Yield	ASTM D638	3,200	psi
Environmental Stress Crack Resistance (Condition C)	ASTM D1693	>2,000	F_0 hrs
Hydrostatic Design Basis	ASTM D2837	1,600	psi
Carbon Black	ASTM D1603	minimum 2	%
Elongation at Break	ASTM D638	850	%



Weholite provides all the technical advantages of equivalent polyethylene solid wall pipe with substantial savings in weight combining greater ease of installation with increased cost effectiveness.

Weholite pipe represents the latest advances in both material and manufacturing techniques. Its unique structure can offer a range of pipe sizes and ring stiffness, depending on customer requirements. Raw material properties and product technology have been combined to provide a lightweight engineered pipe with superior loading capacity for various applications in municipal, industrial, road construction, rehabilitation and marine pipeline applications.

Weholite today is manufactured in Canada, United States, Finland, Sweden, Denmark, Poland and Thailand. In addition KWH Pipe Ltd. has granted manufacturing licenses in the United Kingdom, Italy, South Africa and Oman.

For technical advice and information please contact your local KWH Pipe office.

Weholite

Product Size Range

Weholite Pipe Size	Nominal ID (inches)	Average Outside Diameter	
		for Max. Stiffness (inches)	for Min. Stiffness (inches)
15	15	16.9	16.5
18	18	20.2	19.9
19.5	19.5	21.7	21.7
21	21	23.7	22.9
24	24	27.1	26.2
27	27	30.4	30.0
30	30	33.8	32.7
36	36	40.7	39.1
40	40	45.2	43.4
42	42	47.5	45.4
48	48	53.8	51.8
54	54	60.5	58.7
60	60	67.2	65.2
66	66	73.9	70.7
72	72	80.6	77.8
78	78	87.4	84.5
84	84	94.1	90.5
90	90	100.8	97.2
96	96	107.5	103.2
108	108	121.0	115.9
120	120	134.4	128.6

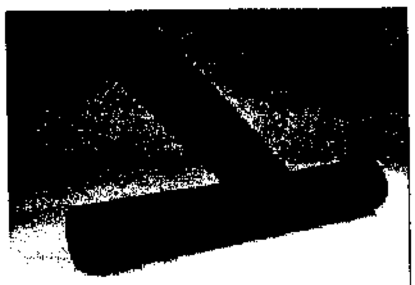
Notes:

1. The above chart represents a range of sizes and stiffness classes. Stock will vary from plant to plant. Contact your local distributor for these stocked sizes.
2. Weholite is available in a series of different Ring Stiffness Constants (RSC) values that comply with ASTM F-894-98 "Polyethylene Large Diameter Profile Wall Sewer and Drain Pipe".
3. Weholite is also available in various Pipe Stiffness values (PS) that comply to CSA B182.6-M92 "Profile Polyethylene Sewer Pipe and Fittings" and to BNQ P3624-120 "Smooth Inside Wall Pipes for Rain Water Drainage and Soil Drainage".
4. Weholite is available in lengths of 3 feet to 50 feet.

Other Products

The Weholite system offers a comprehensive selection of fittings including elbows, tees, and laterals. Weholite can also be used for manholes and tanks.

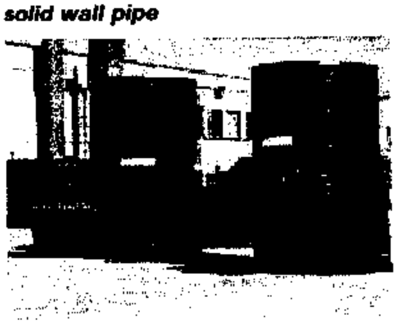
Weholite elbow



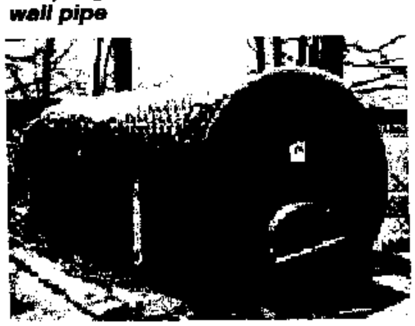
Weholite lateral

Elbow with bell ends fabricated from solid wall pipe

Coupling fabricated from solid wall pipe



Weholite manholes

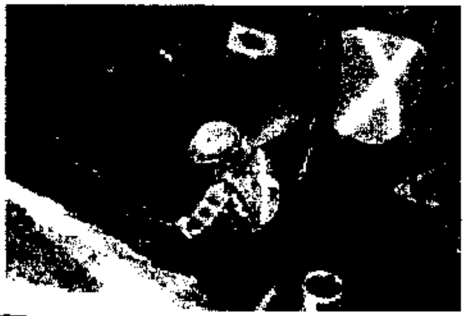


Horizontal tank made from Weholite

Pipe Joining Methods

Bell and Spigot Connection - Pipe Sizes (15" - 36")

The bell and gasket joint is watertight and conforms to ASTM D3212. The rubber gasket conforms to ASTM F477 and is resistant to normal sewage. Resistant sealings for oil contaminated water are available upon special request.

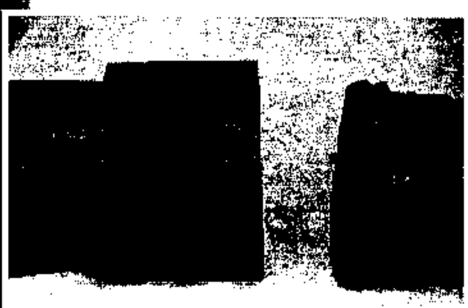


Ensure that the spigot and bell ends are clean from sand and dust. Install the gasket onto the spigot end.

Mark the "Stop push" line and apply lubricant evenly to the gasket and to the inside of the bell.

Align the bell and spigot joints together.

Gently force the spigot into the bell mouth using suitable force. Stop at the "Stop-Push" line. Small pipes can be pushed in by hand. Larger pipes can be pushed together with a backhoe bucket. Always protect the pushing end with a plywood sheet or suitable plank.



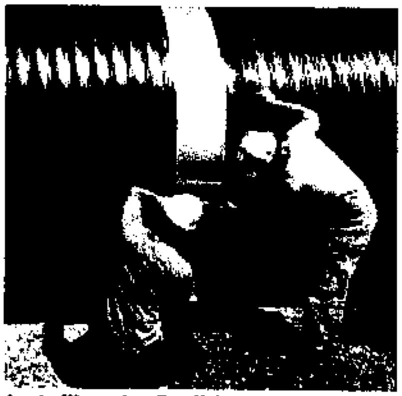
Bell and spigot connection with gasket

Bell and spigot spool piece

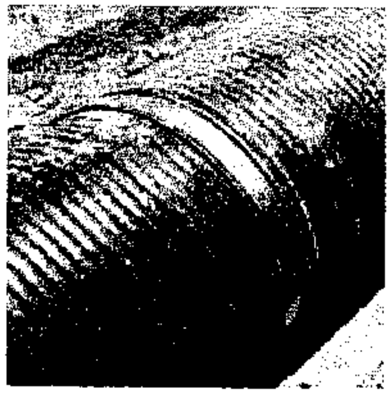
VALUE ENGINEERING STUDY

Weholite Flexible Couplings-Pipe Sizes (15" - 120")

Flexible Couplings provide an easy and cost effective method of giving an external seal when joining two of the same sized Weholite pipes. The coupling can be comprised of an elastomeric sleeve made from Ethylene Propylene DiMethyl (EPDM) or rubber and is highly corrosion resistant. Stainless steel perimeter clamps and a shear ring, are used for adjustment and ensure proper coupling alignment. Weholite Flexible Couplings are available in 12 and 16 inch widths.



Installing the flexible coupling

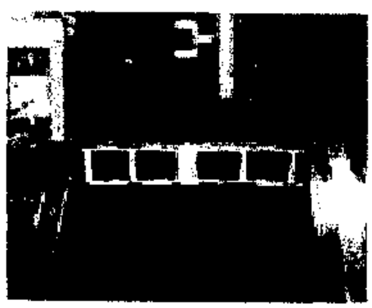


A large Weholite flexible coupling

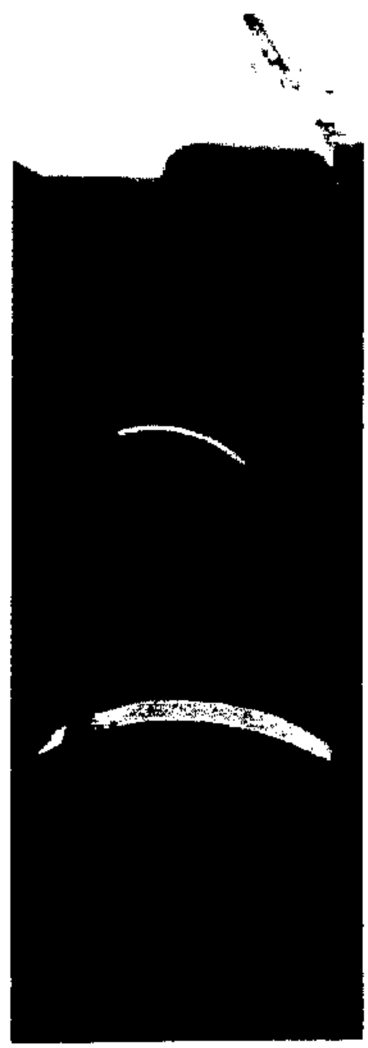
Extrusion Welding-Pipe Sizes (30" - 120")

Extrusion welding is mostly used for low pressure applications and for large diameter pipe. Welding is done from inside or outside or both. All welding must be carried out by skilled personnel. Welding on the inside can also be used in conjunction with an exterior flexible coupling (see above).

Hand extrusion welding



Welding provides a joint absolutely water tight and as strong as the pipe itself.



Bedding

The pipe stiffness is chosen with regard to soil type, bedding and backfill material, depth of installation and external live and dead loads (ground water, traffic, etc.) on the pipeline. Please refer to national codes of practice for installation of plastic pipes wherever applicable.

Pipe Bedding

The bedding soil shall be free from stone within the breadth of the pipe trench. On the trench bottom, a 4 to 6 inch thick bedding layer is prepared and well compacted. The bedding shall be at least 8 inches wider than the pipe outside diameter. For installations in soft/wet soil, a geotextile is placed under the bedding.

Primary Backfill

The primary backfill material shall be a friction soil. Backfilling shall be made over the whole width of the trench. Compaction of the backfill material shall be made in layers of 6 to 12 inch. The final layer of the primary backfill shall extend 12 inches over the pipe crown.

Note: No compaction is to be done directly above the pipe until the backfill has reached 12 inches above the pipe crown.

Final Backfill

The final backfill is done with full consideration given to the original soil and external loads to be encountered (traffic). When deemed necessary, the compaction is carried out in several layers. This final backfill material can be the excavated material provided it is suitable. The backfill must, however, be free of stones.

Installation Depth

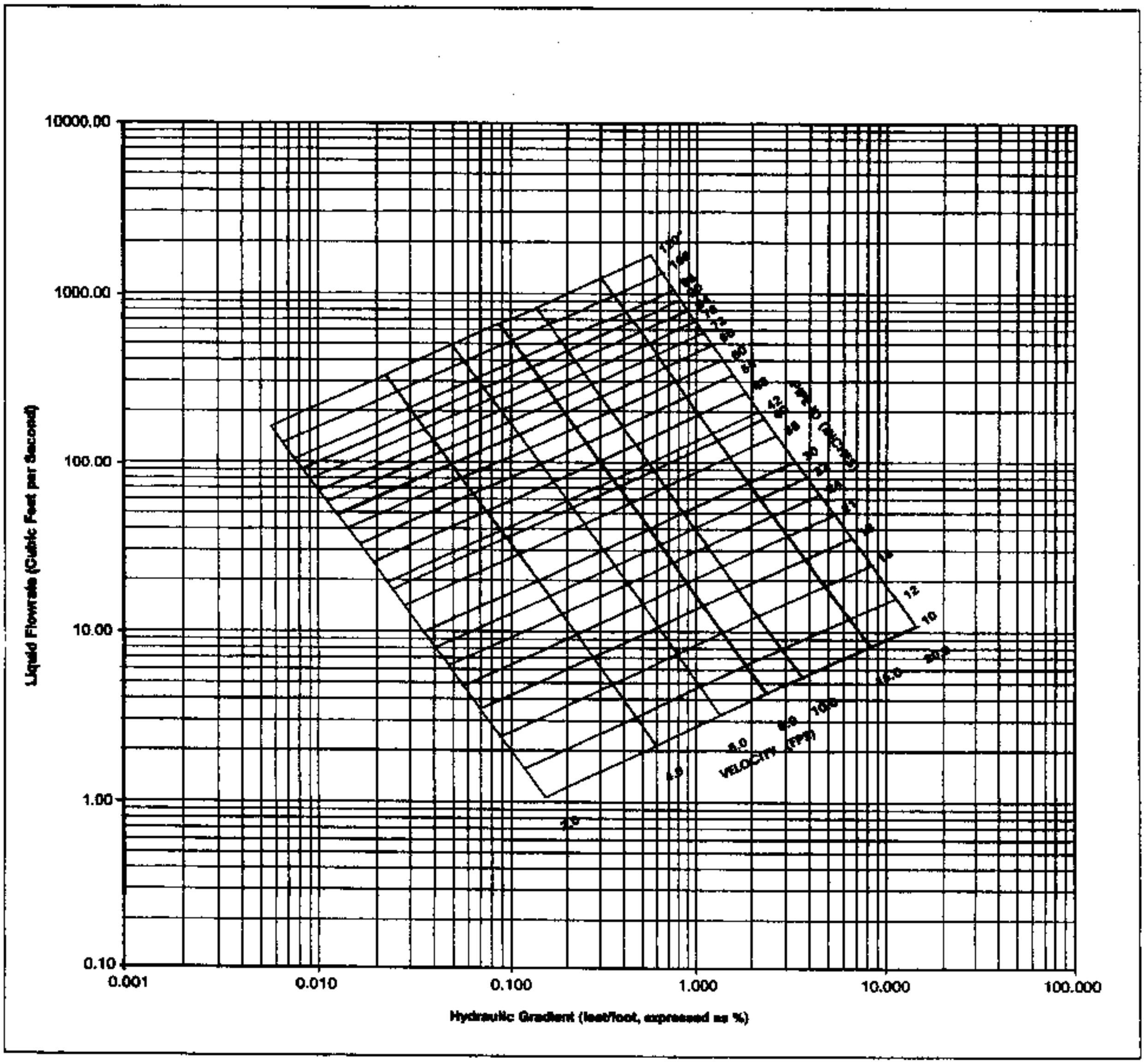
Recommended installation depth is 1 to 30 feet depending on the expected external loads (ground water, traffic, etc.).
For pipe sizes above 48 inches, detailed static calculations are normally necessary to determine the required trench proportions and pipe stiffness.

Quality Aspects

KWH Pipe maintains complete quality control from raw material to finished pipe product by establishing strict manufacturing specifications.
Our Weholite production facilities are ISO 9002 certified.

Weholite quality requirements consist of:
1. Raw-material testing
2. Geometry and tolerances measurement
3. Product performance evaluation

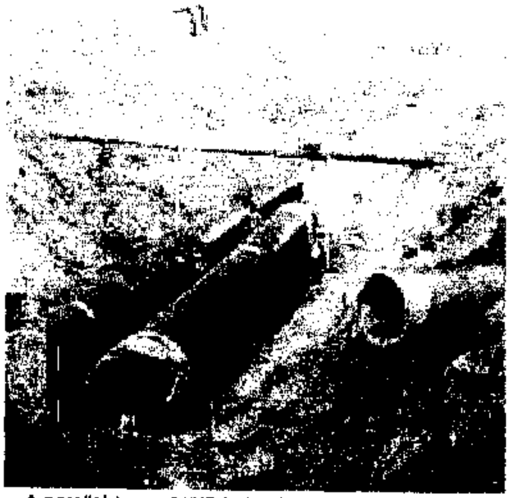
Discharge Volume Rate for Weholite Flowing Full



Manning number n = 0.010

Installations

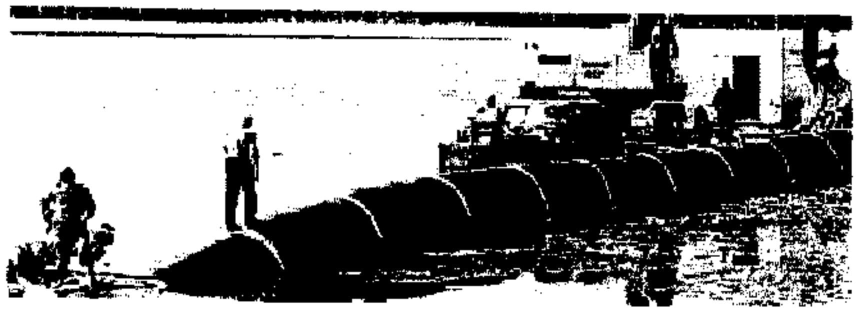

96" Weholite used for water management on a golf course.


A parallel, two x 54" ID industrial wastewater pipeline. Total length 6,700 feet.


Inspection chambers made from 78" Weholite pipes for a Cellulose Plant.


Relining of 2,100 feet, 72" corroded concrete pipe with 60" Weholite pipe. Total project completed in 8 weeks.


Culvert under railway. Open cut replacement finished in 3 hours using 48" and 60" pipe.


3,000 feet of 48" pipe used for a cooling water discharge line from a peat power plant. Submerged in a reservoir.

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Mississauga, Ontario
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Canada
Tel. 905 858-0206
Fax. 905 858-0208

Western USA
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Suite 320
Granada Hills, California
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Tel. 818 831-8787
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Poland (Warsaw)
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